
Diabetes in Indiana

A Report on Diabetes Morbidity and Mortality



Indiana State
Department of Health

**Diabetes in Indiana:
A Report on Diabetes Morbidity and Mortality**

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**Indiana State Health Commissioner
Gregory Larkin, M.D.**

**Chronic Disease Prevention and Control Director
Meenakshi Garg, MD, MPH**

Authors

**Rizwana A. Biviji, MS., Epidemiologist, Diabetes Prevention and Control Program, ISDH
Laura Heinrich, Director, Diabetes Prevention and Control Program, ISDH
Linda W. Stemnock, B.S.P.H, Data Analyst and BRFSS Coordinator, ISDH
Champ Thomaskutty, Epidemiologist, Diabetes Prevention and Control Program, ISDH**

**Indiana State Department of Health
2 North Meridian Street
Indianapolis, IN 46204
www.in.gov/isdh**



Mitchell E. Daniels, Jr.
Governor

Gregory N. Larkin, M.D., F.A.A.F.P.
State Health Commissioner

August 30, 2010

Dear Hoosiers:

Diabetes has become one of the most widespread epidemics facing the nation. In Indiana it has emerged as one of the most prevalent and costly diseases affecting our state. Hoosiers living with this disease face a lower quality of life, shorter life expectancy, and higher healthcare costs. It is estimated that almost 600,000 adults in Indiana have diabetes. Unfortunately, there is also a growing trend of children and adolescents developing the disease.

This report quantifies the impact of the disease in the state and should encourage all members of the community to join the fight against diabetes. While the impact of diabetes may appear daunting, there is room for optimism. Diabetes is not inevitable, and in many instances can be prevented. Improved nutrition, increased physical activity, appropriate screening, and timely intervention may prevent many cases of diabetes. For those with the disease, these same actions can delay its progression and reduce its complications.

Please join the Diabetes Prevention and Control Program at the Indiana State Department of Health in our efforts to reduce the burden of diabetes in Indiana and improve the quality of life for all Hoosiers.

Sincerely,

Gregory N. Larkin, M.D., FAAFP
State Health Commissioner

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Diabetes in Indiana: An Overview

Scope of the Problem

- In 2008, 9.6% (n= 455,000) of Indiana's adult (18 years of age and older) population reported that they have been diagnosed with diabetes ⁽¹⁾ compared to the national average of 8.2 % ⁽²⁾ This value includes individuals with type 1 and type 2 diabetes.
- It is estimated that 2.9% (n= 137,200) of the Indiana adult population have undiagnosed diabetes. ⁽³⁾
- It has been reported that 0.2% of Hoosier children and adolescents (under 18 years of age) have been diagnosed with type 1 diabetes. ⁽³⁾
- Diabetes was the 7th leading cause of death in Indiana in 2007. It was the 4th leading cause of death for non-Hispanic blacks, 7th for non-Hispanic whites and 8th for Hispanic individuals. ⁽⁴⁾
- The average annual health care cost for a person with diabetes in the United States was \$11,744 in 2007, compared with \$2,935 for a person without diabetes. ⁽⁸⁾

Populations at Risk

- **Older Adults** – Hoosiers 65 years and older (12.7% of Indiana's population in 2008) had a diabetes prevalence of 21.3% in 2008. ⁽²⁾
- **Race/Ethnicity**
 - Non-Hispanic black adults had a diabetes prevalence of 14.6%. ⁽²⁾
 - Non-Hispanic white adults had a prevalence of 8.8%. ⁽²⁾
 - Hispanic adults had a diabetes prevalence of 5.4%. ⁽⁹⁾
 - Asian, Native Hawaiian/Pacific Islanders, American Indian/Alaskan Native, or other adults had a diabetes prevalence of 7.0 %. ⁽²⁾
 - Those identifying themselves as having two or more races had a diabetes prevalence of 3.9%. ⁽⁹⁾
- **Gestational diabetes** – In 2008, 1.4% of women reported they had ever been diagnosed with gestational diabetes (diabetes during pregnancy). ⁽²⁾ Of these women , 40–60% have a chance of developing diabetes in the next 5–10 years and about 5–10% will have type 2 diabetes immediately following pregnancy. ⁽³⁾
- **High blood glucose or pre-diabetes** – 26.0% of Indiana's population have pre-diabetes putting them at risk for developing diabetes in the future. ⁽³⁾
- **Overweight or Obese** – 63.6% of adults in Indiana were overweight or obese in 2008. Of the adults with diabetes, 33.5% were overweight and 52.8% were obese. ⁽²⁾
- **Sedentary lifestyle** – 27.7% of Indiana adults did not participate in any physical activity in the previous month. ⁽²⁾
- **Smoking** – In 2008, 26.0% of Indiana's adult population were currently smoking. ⁽²⁾

Complications due to Diabetes

- **Death** – 1,679 individuals died from diabetes as the underlying cause of death, and 3,204 individuals died from diabetes as a contributing cause of death.⁽⁴⁾
- **Hospitalizations** – 10,682 individuals seen as inpatients in the hospital had the primary diagnosis of diabetes.⁽⁵⁾
- **Heart attack** – 18.9% of individuals with diabetes reported that they had been told they had a heart attack, and 16.5% have been told by a health care professional that they have angina or coronary heart disease.⁽¹⁾
- **Stroke** – 11% of individuals with diabetes reported they have been diagnosed with a stroke.⁽¹⁾
- **Blindness** – 135 new cases of legal blindness and 52 new cases of visual impairment were due to diabetic retinopathy in adults 18 years of age and older.⁽⁶⁾ Of adults with diabetes, 20.0% have been told that their diabetes has affected their eyes or caused retinopathy.⁽¹⁾
- **Kidney disease** – 919 of the 2,203 new cases of end stage renal disease were individuals with diabetes.⁽⁷⁾
- **Lower extremity amputations** – 1,668 individuals with a primary hospital discharge diagnosis of diabetes underwent a lower extremity amputation.⁽⁵⁾
- **Depression** – 27.6% of individuals with diabetes reported they had been diagnosed with a depressive disorder.⁽¹⁾
- **Dental Disease** – 21.5% of adults with diabetes have had six or more (including all) teeth removed compared to 5.1% in adults without diabetes.⁽¹⁾

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All population estimates are from the United States Census Bureau, American Community Survey, 2007 and 2008.
quickfacts.census.gov/qfd/states/18000.html.

Introduction

Diabetes is a serious, costly and growing public health problem in Indiana. In simple terms, diabetes is a group of diseases which result in high blood glucose levels due to improper production or response to insulin, a natural hormone. The impact of high blood glucose and the long-term consequences of diabetes will be discussed throughout this report. In the United States, the prevalence of diabetes has reached epidemic levels, and has been growing by almost 5% each year.⁽¹⁾ Common symptoms of diabetes include frequent urination, extreme thirst and hunger, unusual weight change, fatigue, irritability, blurred vision, very dry skin, numbness and tingling in the hands and feet, and slow healing of cuts and bruises. Nausea, vomiting, and stomach pains can also accompany some of these symptoms in the abrupt onset of type 1 diabetes.⁽²⁾

Incidence: In 2008, there were approximately 1.6 million new cases of diabetes diagnosed nationally in individuals 20 years or older. Of those new cases, 281,000 were among individuals aged 20-39 years, 819,000 were aged 40-59 years, and 536,000 were individuals over 60 years of age.⁽²⁾

Prevalence: In 2008 the estimated total number of individuals in the United States with diabetes was 23.6 million, approximately 7.8% of the adult population. Of this estimate, 17.9 million were diagnosed cases and 5.7 million were undiagnosed cases. It is estimated that almost one-fourth of all diabetes cases are undiagnosed.⁽²⁾

Diabetes is one of the most common chronic diseases among children in the United States and is becoming more prevalent. The Centers for Disease Control and Prevention (CDC) and the National Institutes of Health (NIH) funded a five-year, multi-center study, *SEARCH for Diabetes in Youth*, to examine the status of diabetes in children and adolescents in the United States.

- Approximately 186,000 individuals under age 18 have diabetes, meaning approximately 0.2% children and adolescents are affected.
- More than 13,000 children are diagnosed with type 1 diabetes each year.
- The rate of new cases of diabetes among youth was 19.0/100,000 for type 1 diabetes and 5.3/100,000 for type 2 diabetes.⁽²⁾

This nationwide increase in diabetes incidence and prevalence is also seen in Indiana's population. However, the prevalence in Indiana is currently higher than the national average. Diabetes is a public health concern because the disease and its complications are largely preventable. The Diabetes Prevention and Control Program (DPCP) at the Indiana State Department of Health (ISDH) compiles and disseminates diabetes data based on the most recent mortality and morbidity data available, as well as Behavior Risk Factor Surveillance System information. The majority of data available on diabetes relates to adults, and unless specified otherwise combines type 1 and type 2 when discussing issue of prevalence. Therefore, the focus of this report is adults 18 years and older. The objective of this report is to provide general information about diabetes including its causes and complications and trends in incidence and prevalence. The report also describes diabetes-related morbidity and mortality in the state. The hope is that this report will be used to identify areas in diabetes prevention and care that need more attention, to highlight issues that need funding and resources, and to help evaluate programs and efforts to reduce the burden of diabetes in Indiana.^{(3)*}

* Mortality information used in this report is from 2007 Indiana State Department of Health data, the most current at the time of publication

Types of Diabetes

Diabetes mellitus is a group of diseases characterized by high levels of blood glucose resulting from defects in insulin production, insulin action, or both. Insulin is necessary for the body's regulation of blood glucose levels. It is a hormone produced in the pancreas and is involved in the metabolism of sugars, starches, and other foods into energy. If diabetes is not controlled, over time, glucose and fat remain in the blood and damage vital organs. The build-up of glucose in the blood is called hyperglycemia.⁽²⁾

Type 1 diabetes, formerly known as juvenile-onset diabetes or insulin-dependent diabetes mellitus, most often appears during childhood or adolescence and accounts for 5-10% of all diagnosed cases of diabetes. In type 1 diabetes, the body's immune system destroys the cells that produce insulin. Since the body produces little or no insulin, individuals with type 1 diabetes must take insulin daily through injection or an insulin pump to survive. Type 1 diabetes is usually diagnosed within a short time of onset because the symptoms are severe and occur rapidly.⁽²⁾

Type 2 diabetes, formerly called adult-onset diabetes or non-insulin-dependent diabetes, and usually begins as insulin resistance, a disorder in which cells do not use insulin properly. Over time, the resulting inefficiency contributes to a loss of insulin production capacity by the pancreas. Type 2 accounts for 90–95% of individuals diagnosed with diabetes. Often individuals can control their blood glucose by exercising regularly and watching what they eat. Type 2 diabetes most often appears in individuals older than 40 years of age, but is increasingly being diagnosed in children and teens and is no longer considered a disease exclusive to adults.⁽²⁾

Gestational diabetes is a form of glucose intolerance diagnosed in some women during pregnancy which will increase their risk of developing type 2 diabetes in the future. Gestational diabetes requires treatment during pregnancy to normalize maternal blood glucose levels to avoid infant complications.⁽²⁾

Other types of diabetes may result from specific genetic conditions, immune or endocrine dysfunction, surgery, drugs, infections, or malnutrition. Such forms of diabetes only account for 1-5% of all diagnosed cases.⁽²⁾

Pre-diabetes is a term used to distinguish individuals who are at increased risk of developing type 2 diabetes. Individuals with pre-diabetes have higher blood sugar levels than normal, though not high enough to be diagnosed with diabetes. Pre-diabetes is characterized by impaired fasting glucose (IFG) or impaired glucose tolerance (IGT) and in some cases both. IFG is a condition where the fasting blood sugar level is 100 to 125 milligrams per deciliter (mg/dl) after an overnight fast, and IGT is a condition where the blood sugar level is 140 to 199 mg/dl after a two-hour oral glucose tolerance test.⁽²⁾ Those with pre-diabetes are likely to develop type 2 diabetes within 10 years, unless active steps are taken to prevent or delay diabetes.⁽²⁾

Risk Factors

The exact mechanisms for developing either type 1 or type 2 diabetes are unclear, although it appears to be different for each form of the disease. Risk factors for type 1 include autoimmune, genetic, and environmental factors. Possible explanations for the onset of type 1 diabetes are environmental triggers which stimulate an immune response against the insulin-producing pancreas cells in some genetically predisposed individuals or damage to the pancreas through injury or disease.⁽²⁾ Risk factors for type 2 diabetes include both genetic and lifestyle factors that are classified as either non-modifiable or modifiable. Non-modifiable risk factors for type 2 diabetes include gender, age, and genetic factors such as race/ethnicity. Modifiable risk factors include obesity, physical inactivity, and dietary habits. Although less clear, education and income levels play a role in type 2 diabetes, as those with lower education and income tend to have a higher prevalence of diabetes.

Although these factors are considered distinct classifications, interactions can occur between the two. For example, genes can predispose an individual to developing diabetes but may require environmental and behavioral factors for activation. Consequently, the development of type 2 diabetes is not inevitable, and may be prevented with effective intervention.^(4, 5)

Obesity is a significant risk factor for the development of type 2 diabetes. Additionally, woman who experienced gestational diabetes or gave birth to large-for-gestational-age babies are at increased risk of developing type 2 diabetes later in life. Other factors worth noting include low birth weight, exposure to a diabetic environment in utero, and inflammatory responses, but additional research is needed in these areas to clarify the mechanisms that lead to disease onset.⁽⁵⁾

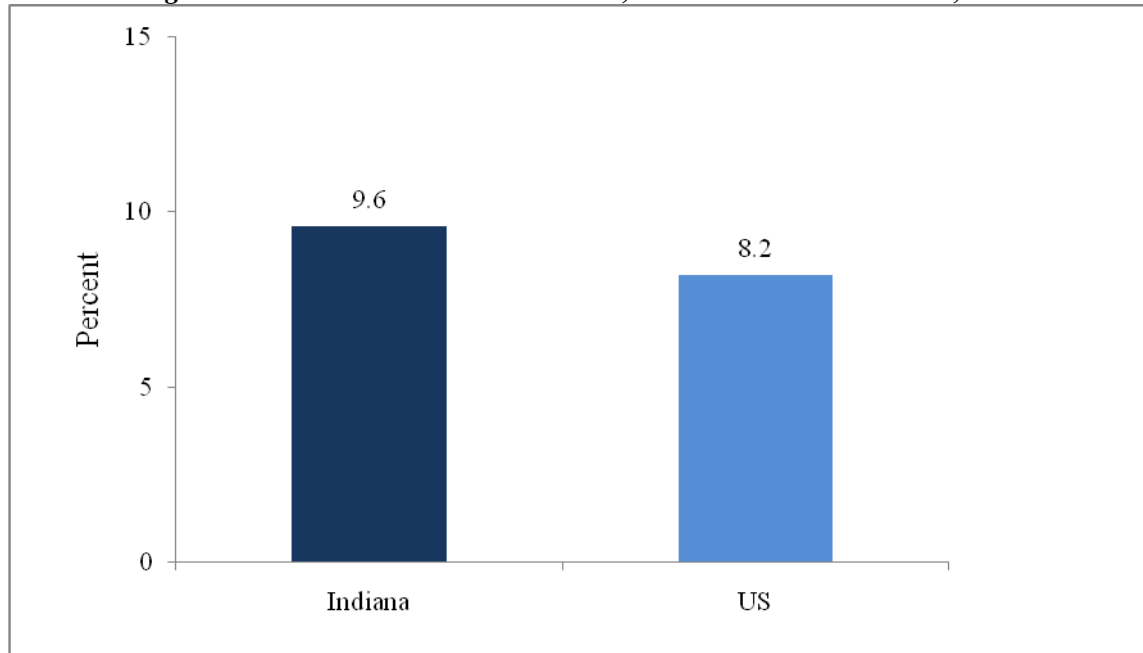
Risk Factors for Type 2 Diabetes

- *Obese or Overweight*
- *Age > 45*
- *One or both parents with diabetes*
- *Member of at-risk ethnic group*
- *Gestational diabetes (or gave birth to a child > 9 pounds)*
- *Hypertension (high blood pressure)*
- *High triglyceride levels*
- *Low HDL Cholesterol levels*

Incidence and Prevalence

An estimated 9.6%* of the adult population in Indiana, approximately 455,000 individuals, reported that they have been diagnosed with diabetes (Figure 1). This rate exceeds the diabetes prevalence of the country as a whole, which is 8.2%. This current rate is indicative of a trend of increasing rates of prevalence in the state (Figure 2). Indiana's age-adjusted diabetes prevalence increased over 45% from 1999 to 2008. It is estimated that an additional 2.9% of the state's adult population has undiagnosed diabetes. A further issue of concern stems from the growing number of individuals with impaired glucose tolerance or impaired fasting glucose, which places them at risk for developing diabetes (Figure 3).

Figure 1: Diabetes Prevalence in Adults, Indiana and United States, 2008



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.

Question: "Have you ever been told by a doctor that you have diabetes?"

Source: Indiana 2008 BRFSS Data

Prevalence by Gender

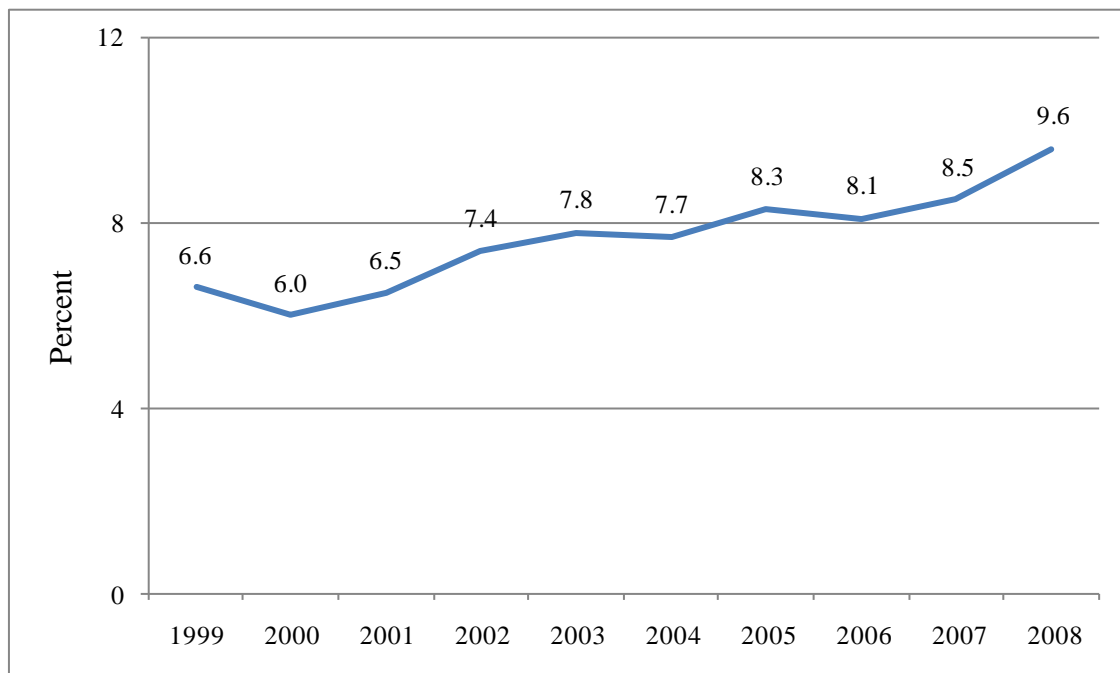
In 2008 adult females in Indiana had higher diabetes prevalence (10.1%) than males (9.0%), although that difference was not a statistically significant. Indiana females also had a higher prevalence than the overall prevalence for females in the United States (7.9%) (Figure 4).^(6, 7) Nationally, female prevalence is similar to male prevalence, as seen in Figure 5.

Gestational Diabetes

Women who have had gestational diabetes are at greater risk of developing type 2 diabetes after pregnancy or in the future. Women who are diagnosed with gestational diabetes have a 20-50% chance of developing diabetes in the next 5-10 years. A portion of women with gestational diabetes (5-10%) will develop type 2 diabetes immediately following a pregnancy. Non-Hispanic black, Hispanic, and Native American females are at greater risk of developing gestational diabetes, as are women who are overweight or obese or have a family history of diabetes.⁽²⁾

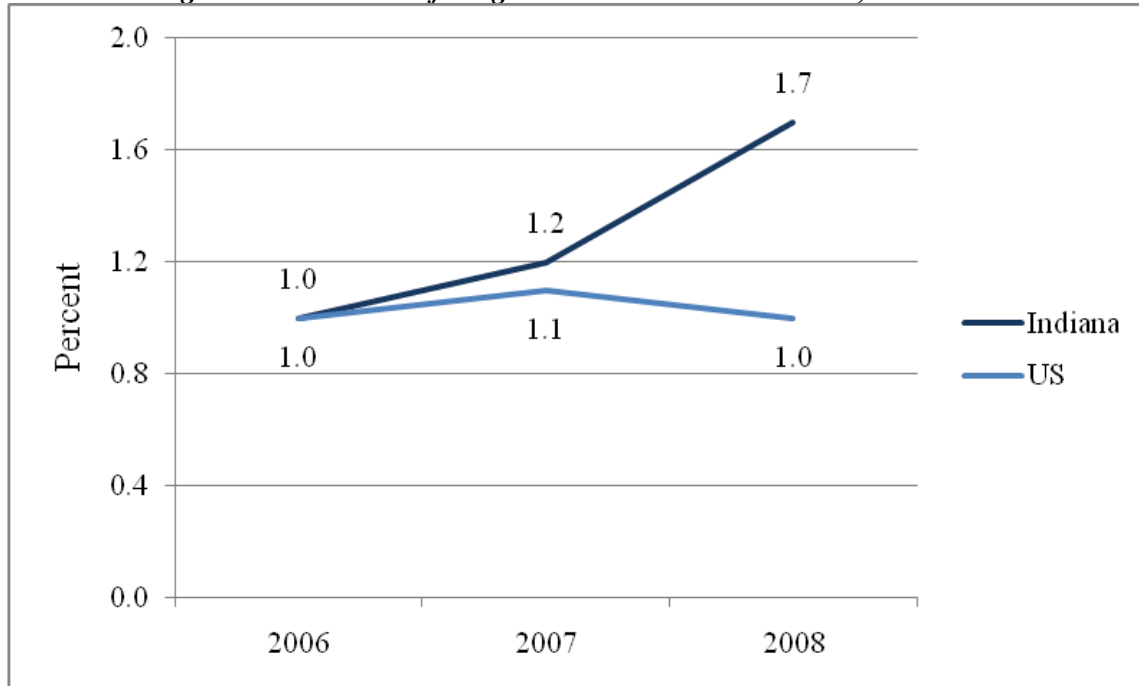
*Unless otherwise specified prevalence values include type 1 and type 2 diabetes.

Figure 2: Prevalence of Diabetes in Adults, Indiana, 1999-2008



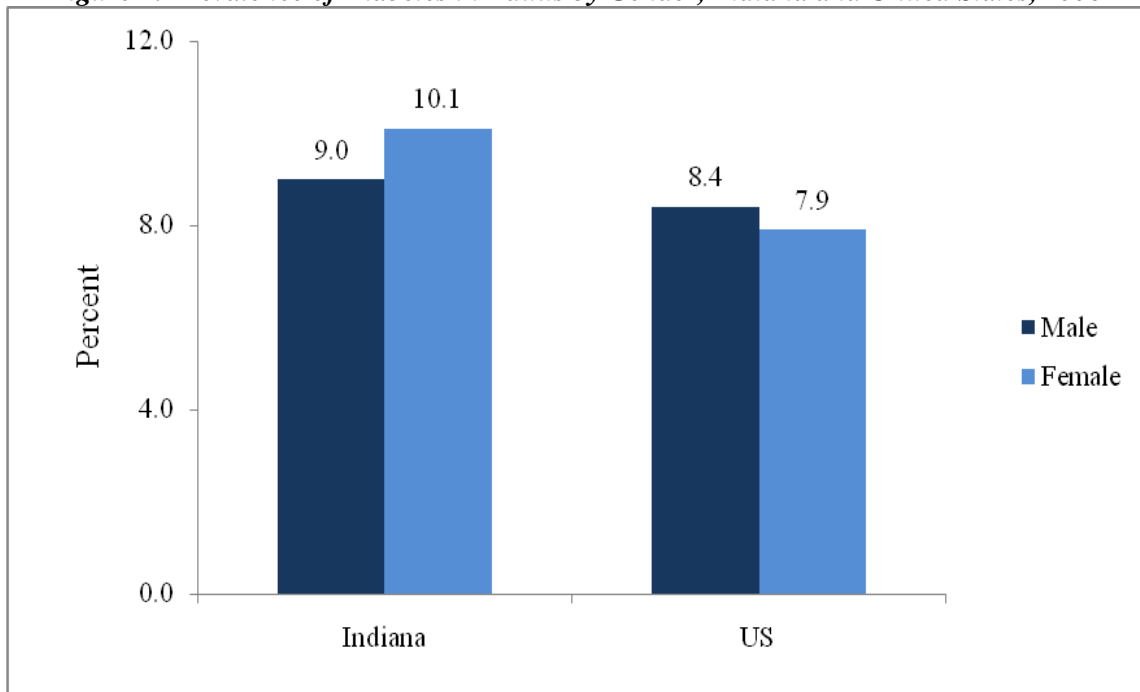
Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.
Question: "Have you ever been told by a doctor that you have diabetes?"
Source: Indiana 1999-2008 BRFSS Data

Figure 3: Prevalence of Diagnosed Pre-Diabetes in Adults, 2006-2008



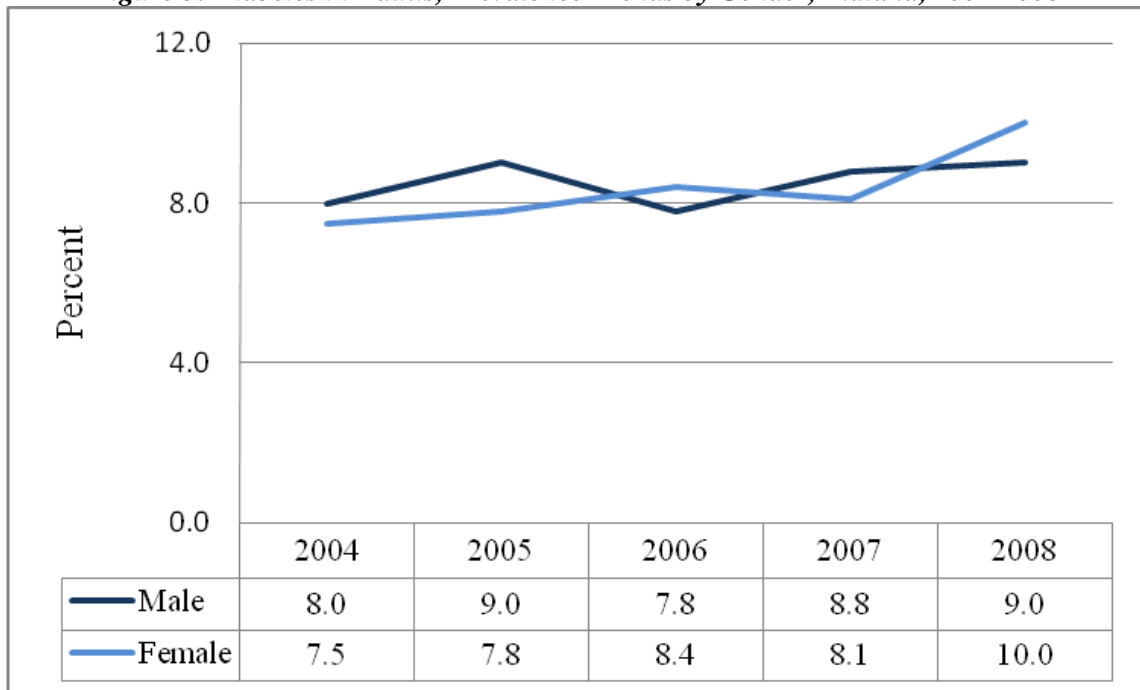
Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.
Question: "Have you ever been told by a doctor that you have diabetes?" - Response: pre- or borderline diabetes.
Source: Indiana 2006-2008 BRFSS Data

Figure 4: Prevalence of Diabetes in Adults by Gender, Indiana and United States, 2008



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.
 Question: "Have you ever been told by a doctor that you have diabetes?"
 Source: Indiana 2008 BRFSS Data

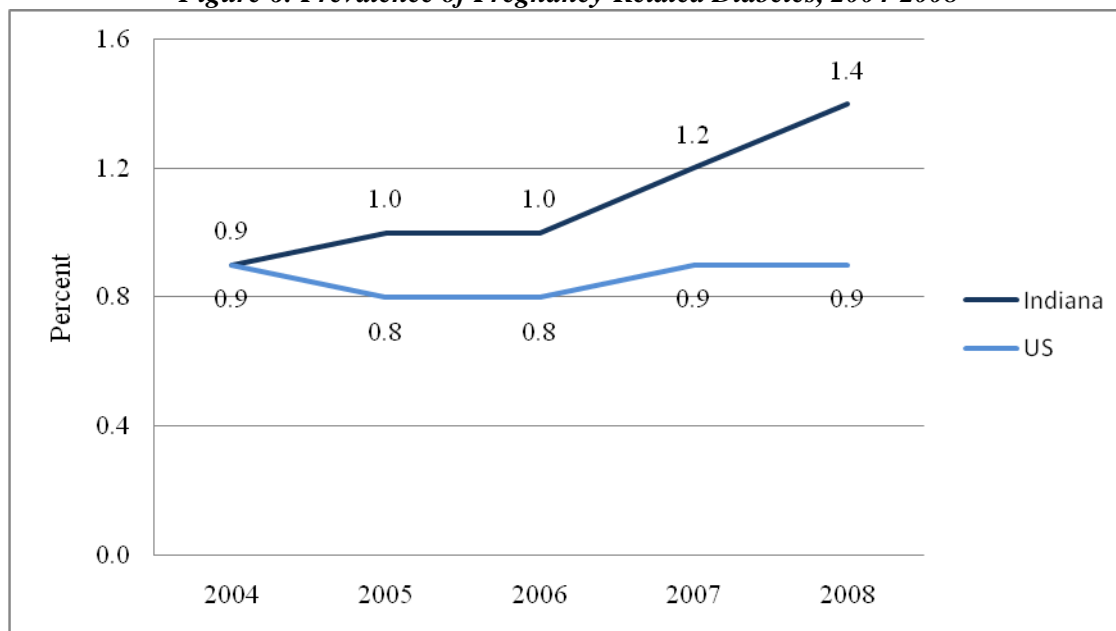
Figure 5: Diabetes in Adults, Prevalence Trends by Gender, Indiana, 2004-2008



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.
 Question: "Have you ever been told by a doctor that you have diabetes?"
 Source: Indiana 2004-2008 BRFSS Data

- In 2008, 1.4% of Indiana adult women reported a previous diagnosis of gestational diabetes. Although this value was higher than the national prevalence of 1.0%, the difference was not statistically significant.
- The prevalence of gestational diabetes in Indiana has been increasing since 2004, and is higher than the national prevalence (Figure 6).

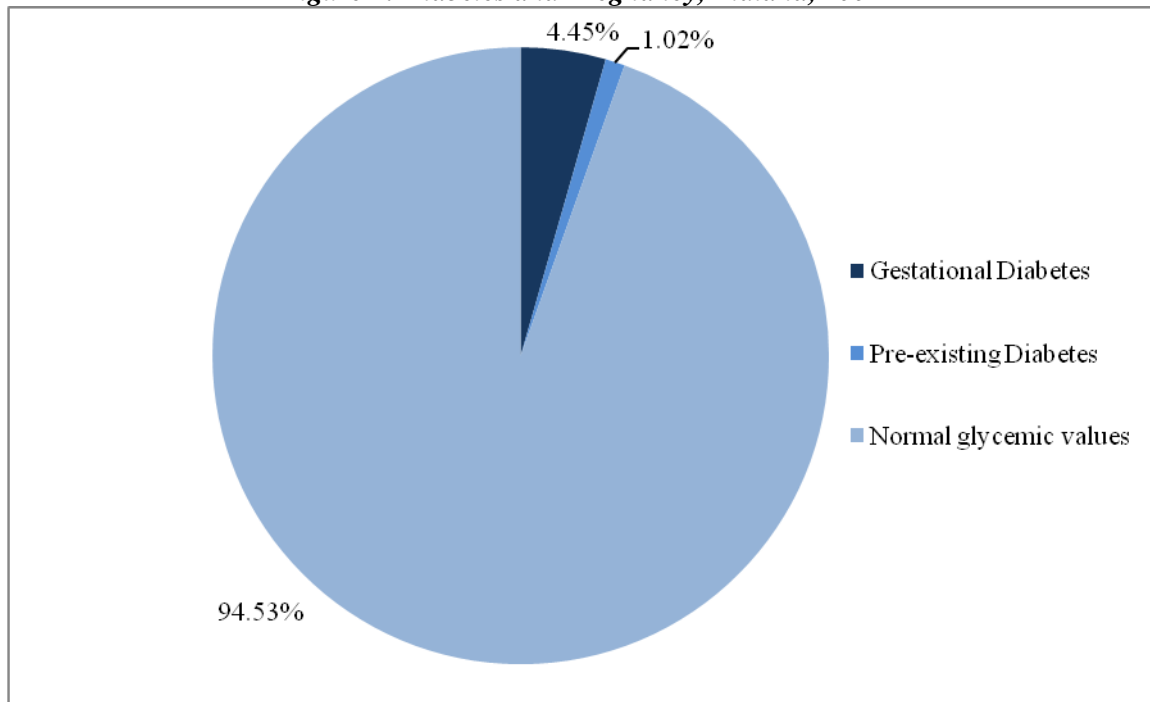
Figure 6: Prevalence of Pregnancy-Related Diabetes, 2004-2008



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.
 Question: "Have you ever been told by a doctor that you have diabetes?"
 Source: Indiana 2004-2008 BRFSS Data

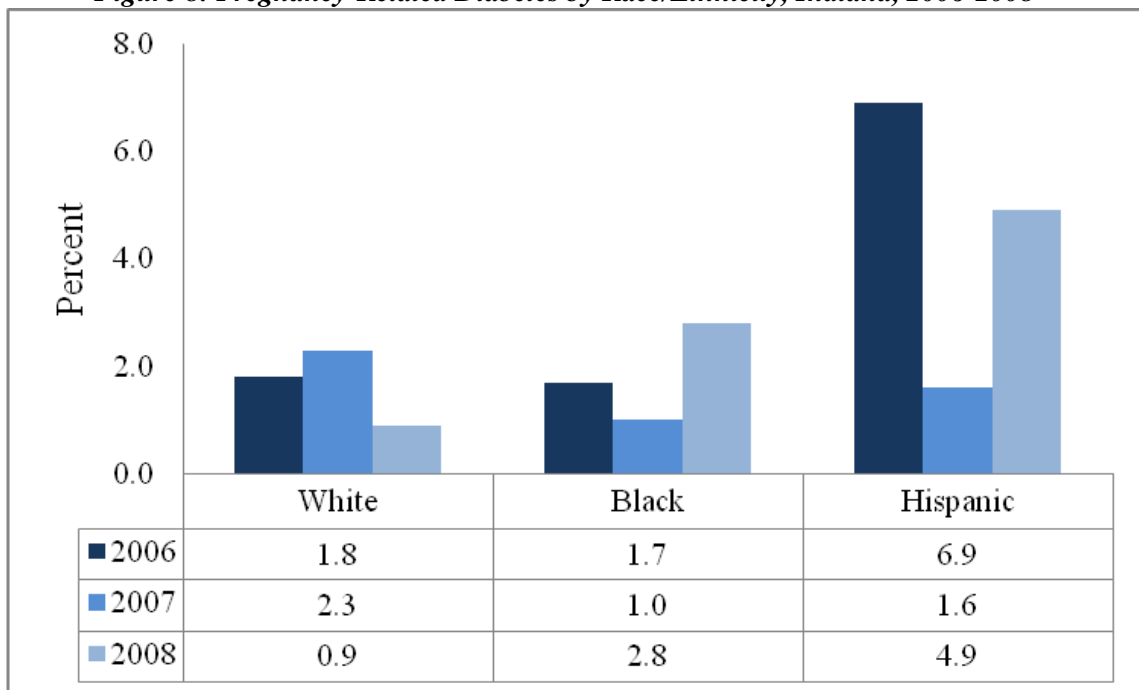
Information from vital records offers a broader assessment of gestational diabetes in Indiana than the BRFSS, as it includes all female residents who gave birth during the calendar year. In 2007, there were 3,989 births where the mother had gestational diabetes, which accounted for 4.45% of births in Indiana. In addition, 912 women reported having diabetes prior to pregnancy, which accounts for 1.02% of births in Indiana (Figure 7).⁽⁹⁾ Differences in prevalence in this population are evident between racial and ethnic groups (Figure 8).⁽⁹⁾

Figure 7: Diabetes and Pregnancy, Indiana, 2007



Note: The revised birth certificate was introduced in 2007 so some variables are not the same as previous years.
Source: Indiana State Department of Health, Vital Records, 2007 Data.

Figure 8: Pregnancy-Related Diabetes by Race/Ethnicity, Indiana, 2006-2008



Note: Data for Other and Multiracial for 2005 and data for Multiracial for 2006 were not available.
Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.
Question: "Have you ever been told by a doctor that you have diabetes?" - Yes, only during pregnancy
Source: Indiana 2006-2008 BRFSS Data

Age

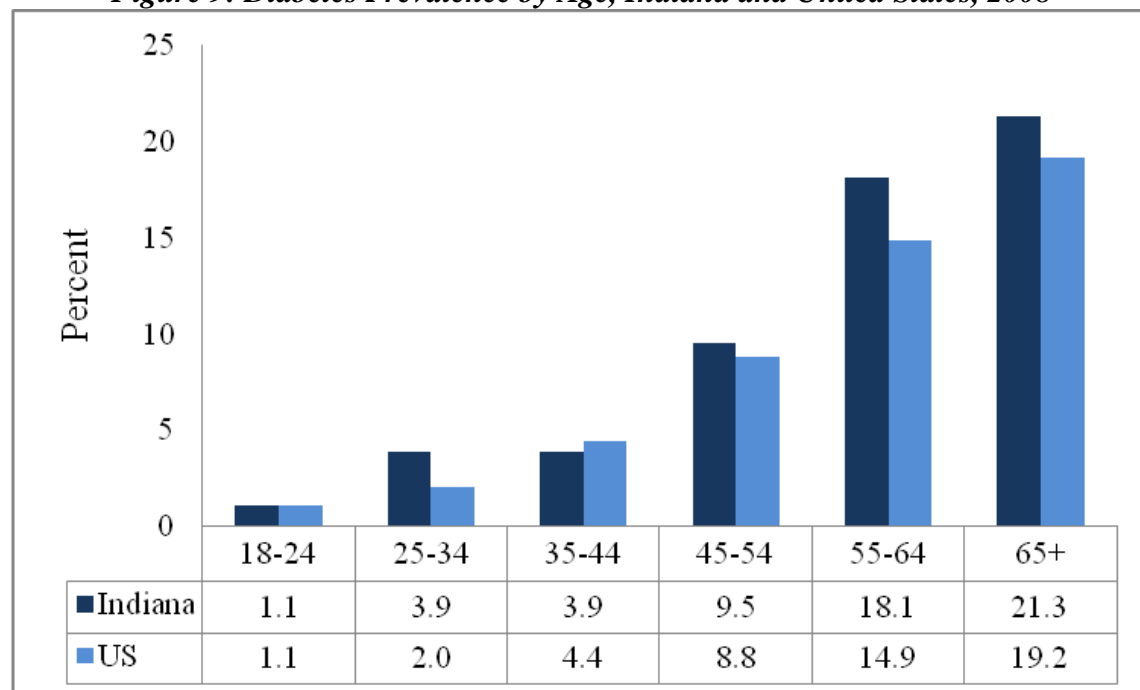
Individuals 65 years or older comprise 12.7% of the Indiana population, representing an approximate increase of 12% from 2005 to 2008⁽¹⁰⁾. It is estimated that by 2025, the number of older Indiana residents will increase to 19% or 1.3 million older persons.⁽¹⁰⁾ This will present a challenge, because individuals 65 years and older currently have the highest diabetes prevalence (21.3%) compared to all other age groups (Figure 9).⁽⁶⁾ Figure 10 shows the diabetes prevalence in each age category since 2006. The majority of adults with diabetes reported that they were first diagnosed between 46-60 years of age, which has remained consistent since 2006 (Figure 11).⁽⁶⁾

Race/Ethnicity

United States Census data for 2008 indicated that 9.1% of Indiana's population was non-Hispanic black, 5.2% was Hispanic, and 1.4% was Asian American/Pacific Islander. Although Indiana does not have Native Americans living in exclusive communities (reservations), 0.3% of Indiana's population was Native American.⁽¹⁰⁾

Non-Hispanic blacks and Hispanics are at higher risk of having diabetes, developing complications, and dying from the disease at earlier ages when compared to their non-Hispanic white counterparts. According to the 2008 BRFSS, non-Hispanic blacks had 14.5% prevalence of diabetes, while whites had an 8.8% prevalence (Figure 12). Non-Hispanic whites and non-Hispanic blacks in Indiana had higher diabetes prevalence than the United States average (Figure 12); however these differences were not statistically significant. When comparing the prevalence over time, nearly all groups demonstrated an increase in diabetes prevalence (Figure 13).

Figure 9: Diabetes Prevalence by Age, Indiana and United States, 2008

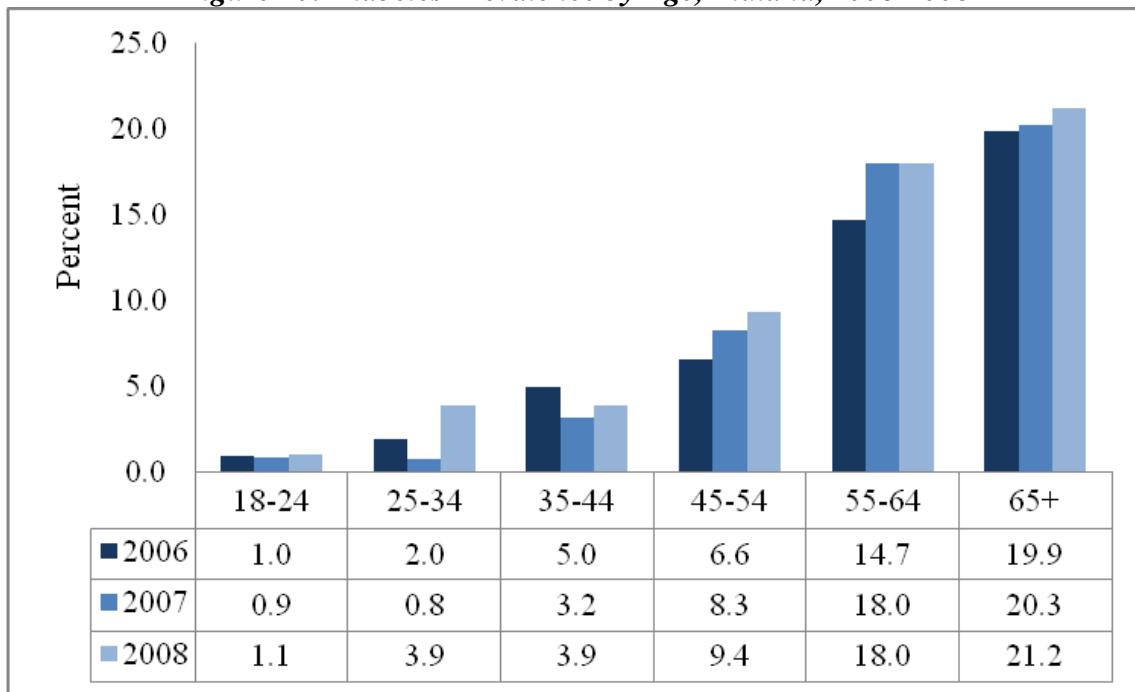


Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.

Question: "Have you ever been told by a doctor that you have diabetes?"

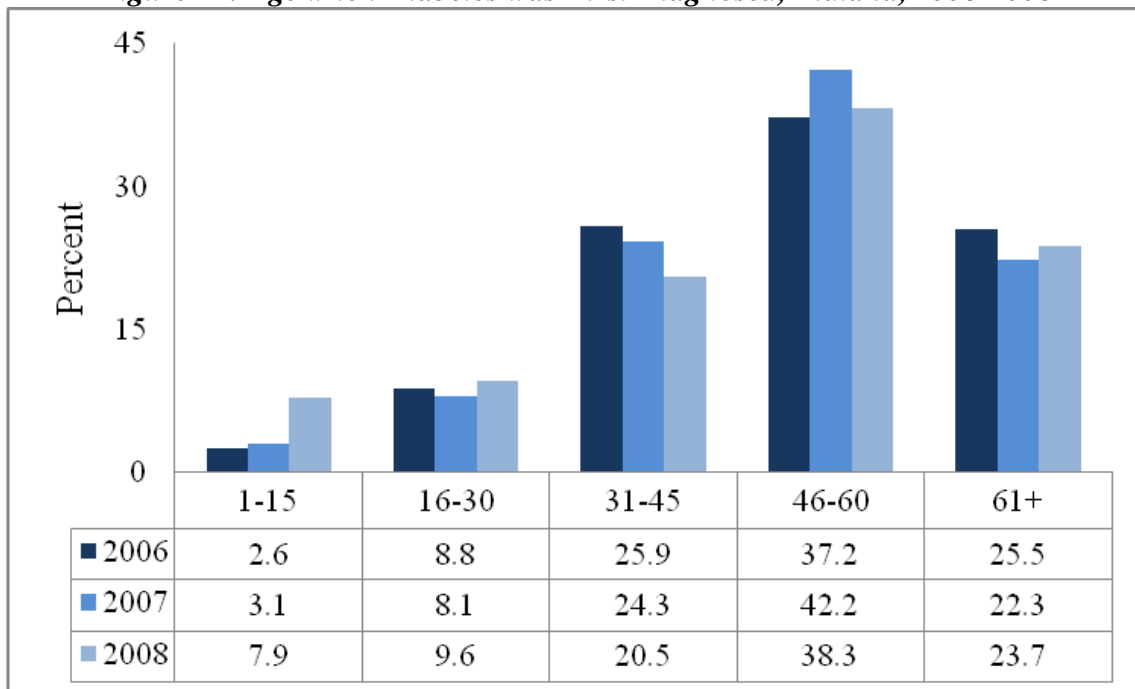
Source: Indiana 2008 BRFSS Data

Figure 10: Diabetes Prevalence by Age, Indiana, 2006-2008



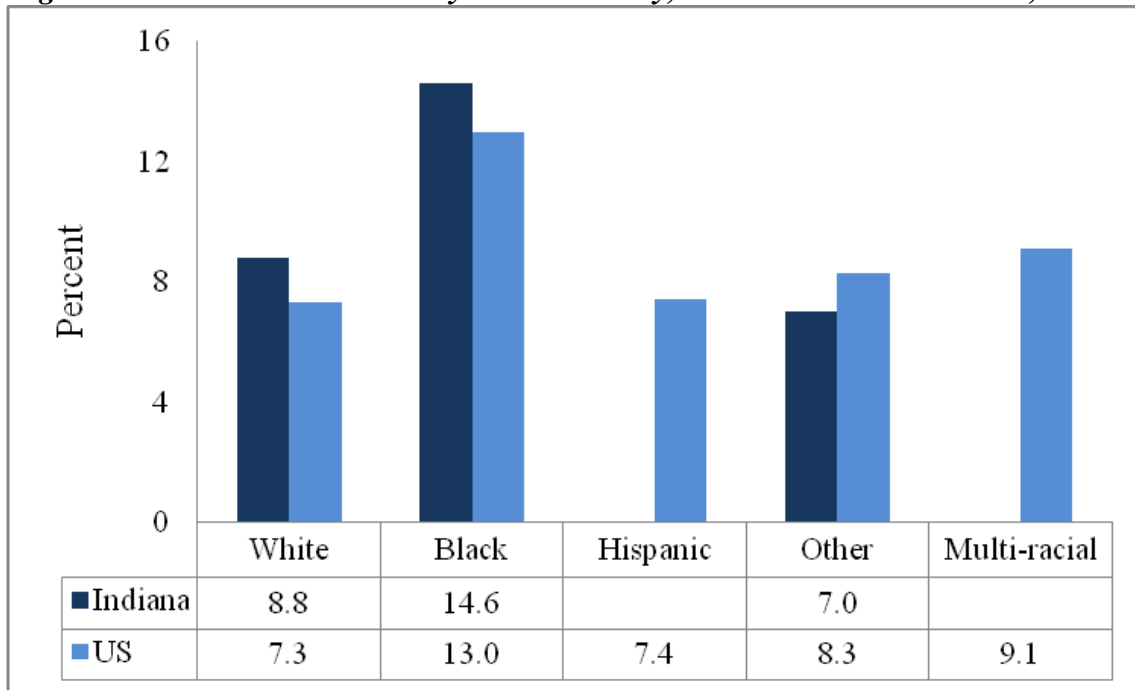
Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.
 Question: "Have you ever been told by a doctor that you have diabetes?"
 Source: Indiana 2006-2008 BRFSS Data

Figure 11: Age when Diabetes was First Diagnosed, Indiana, 2006-2008



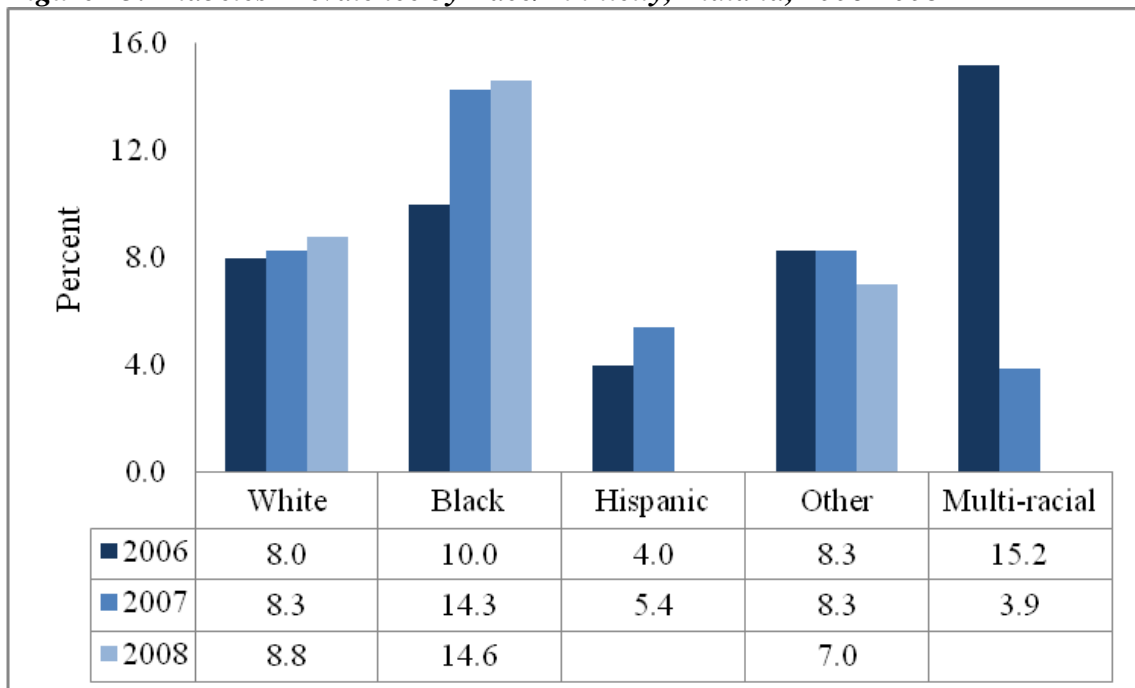
Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.
 Question: "How old were you when you were told you have diabetes?"
 Source: Indiana 2006-2008 BRFSS Data

Figure 12: Diabetes Prevalence by Race/Ethnicity, Indiana and United States, 2008**



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.
Question: "Have you ever been told by a doctor that you have diabetes?" Source: Indiana 2008 BRFSS Data

Figure 13: Diabetes Prevalence by Race/Ethnicity, Indiana, 2006-2008**



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.
Question: "Have you ever been told by a doctor that you have diabetes?" Source: Indiana 2006-2008 BRFSS Data

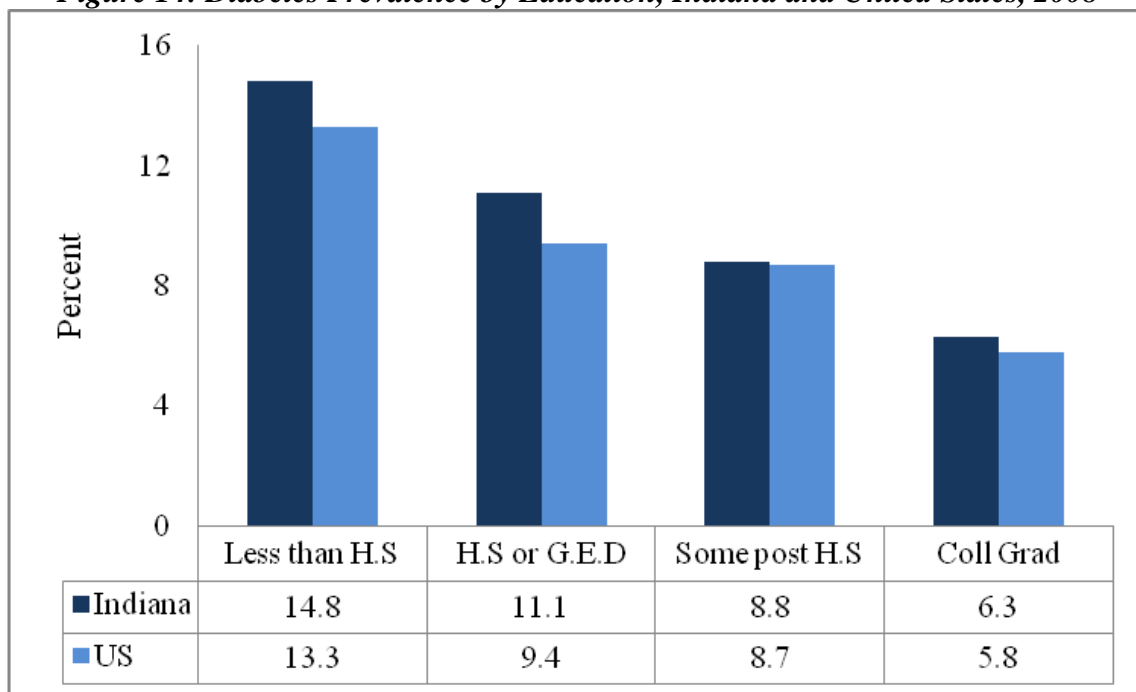
**Note: While the prevalence of diabetes for Hispanics, other races and multiracial respondents varied from 2006 to 2008, the differences were not statistically significant. The low number of respondents from those race/ethnicity categories led to inconclusive comparisons.

Education and Income

Prevalence of diabetes is associated with education and income level. In 2008 the prevalence of diabetes was the greatest among adults with less than a high school diploma (14.8%) and the prevalence was the lowest (6.3%) among those with a college degree (Figure 14). The differences between the levels of education were statistically significant. This trend has been consistent for the past three years (Figure 15).⁽⁶⁾

Individuals with lower income exhibit a higher prevalence of diabetes. In addition to individual income, household income is a predictive factor. Individuals in lower income households are more likely to have diabetes compared to their higher income peers. In 2008 the prevalence for those with an annual household income (from all sources) of less than \$15,000 was 15.2% compared to only 6.9% prevalence in those that had a yearly income of \$50,000 or more (Figure 16). The differences between the levels of income in relation to diabetes prevalence are statistically significant (Figure 17).⁽⁶⁾

Figure 14: Diabetes Prevalence by Education, Indiana and United States, 2008

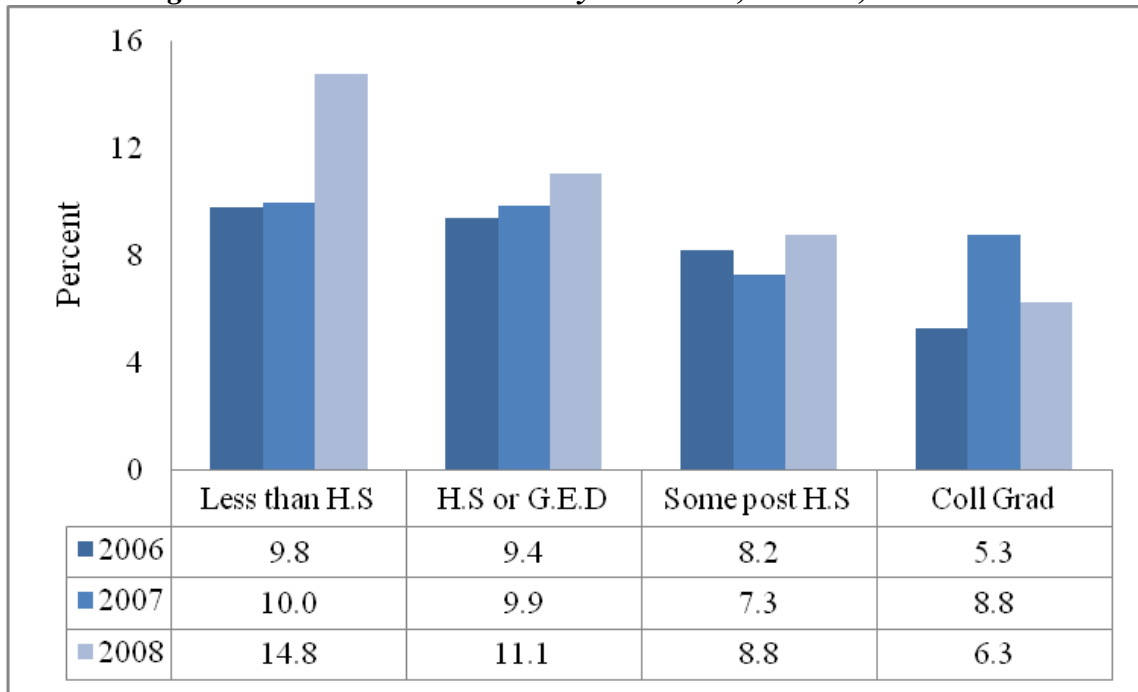


Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.

Question: "Have you ever been told by a doctor that you have diabetes?"

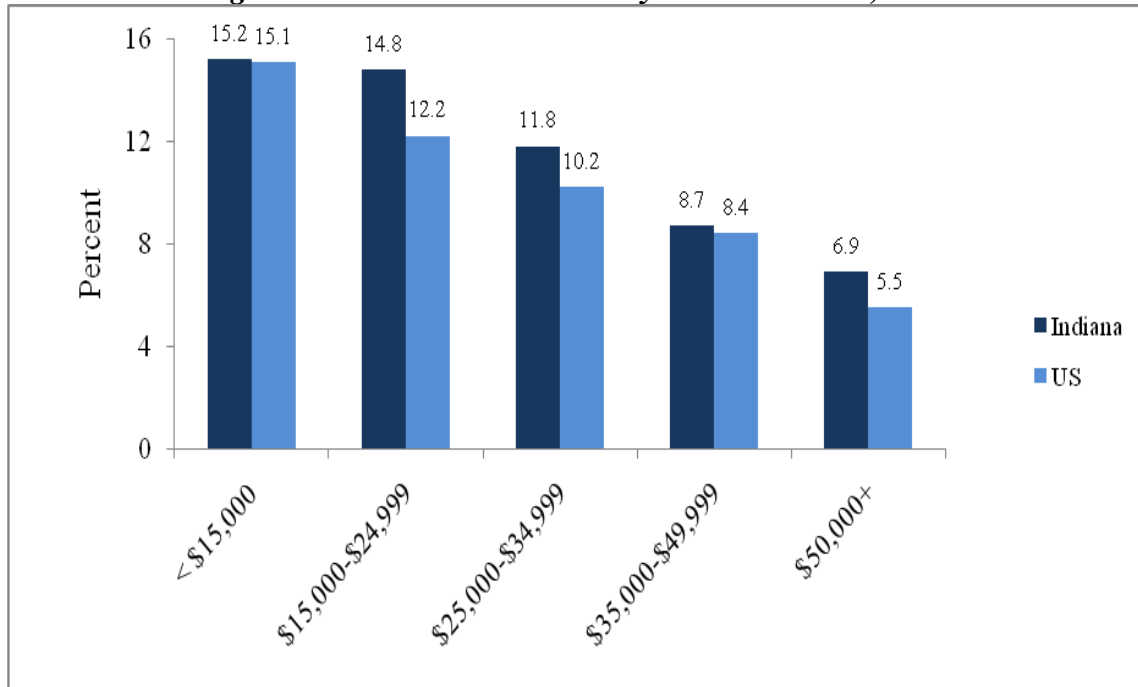
Source: Indiana 2008 BRFSS Data

Figure 15: Diabetes Prevalence by Education, Indiana, 2006-2008



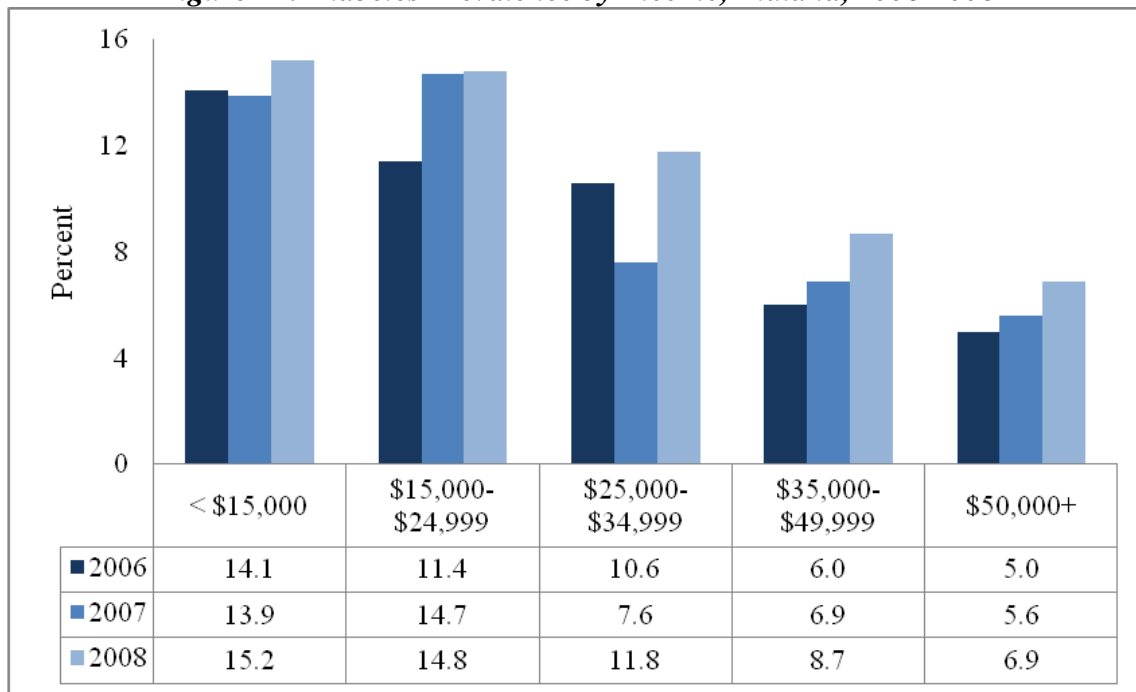
Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.
 Question: "Have you ever been told by a doctor that you have diabetes?"
 Source: Indiana 2006-2008 BRFSS Data

Figure 16: Diabetes Prevalence by Annual Income, 2008



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.
 Question: "Have you ever been told by a doctor that you have diabetes?"
 Source: Indiana 2008 BRFSS Data

Figure 17: Diabetes Prevalence by Income, Indiana, 2006-2008



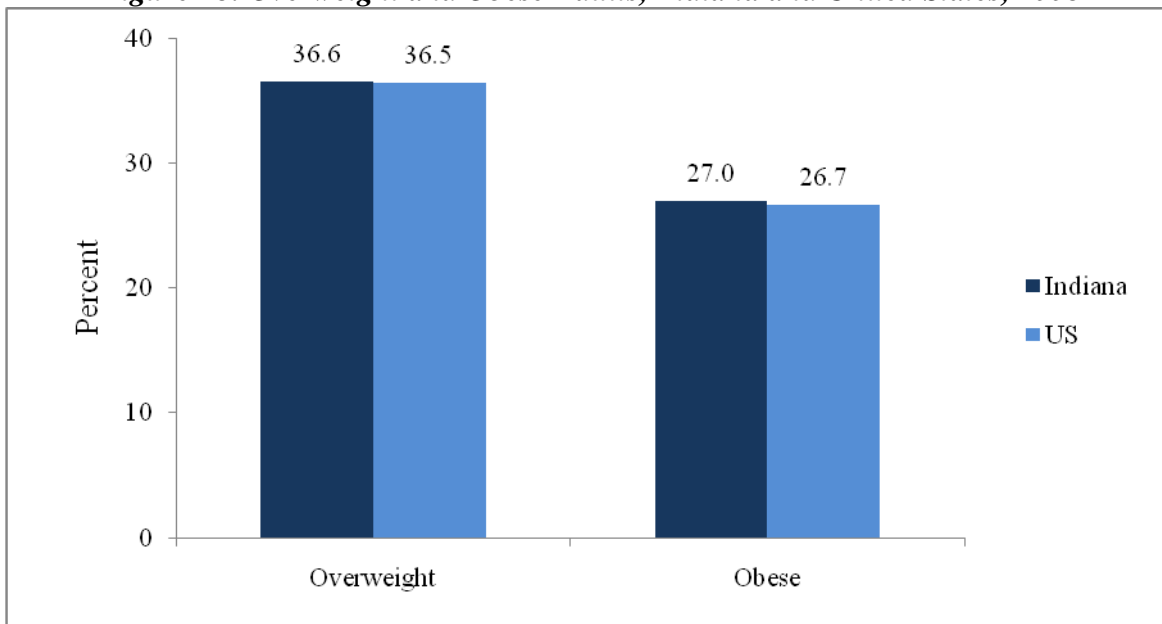
Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.
 Question: "Have you ever been told by a doctor that you have diabetes?"
 Source: Indiana 2006-2008 BRFSS Data

Obesity, Physical Inactivity, and Nutrition

More than 80% of individuals with type 2 diabetes are overweight or obese.⁽¹¹⁾ According to the 2008 BRFSS, 63.6% of Indiana's adults were overweight or obese, similar to the national level of 63.2% (Figure 18). Figure 19 shows the relationship and change among the body mass index categories as Indiana's obesity rates increase. Figures 20 and 21 highlight the specific percentages of overweight and obese adults in Indiana. Males were more overweight than females; however females were just slightly more obese than males. This difference was not statistically significant. In 2008, non-Hispanic black adults had the highest obesity prevalence, and non-Hispanic white adults had the highest prevalence of overweight.⁽⁶⁾ The estimated rates for diagnosed diabetes and obesity in Indiana counties are listed in Table 1.⁽⁷⁾

Physical activity has decreased over recent decades and has been a major contributing factor in the increase in obesity. Studies have shown physical activity to be an independent predictor of type 2 diabetes development.⁽⁵⁾ In 2007, 10.3% of Indiana adults with diabetes participated in 20 minutes or more of vigorous physical activity three times a week compared to 28.4% of adults without diabetes. Overall, 26.5% of adults reported this level of physical activity. When comparing race and ethnicity, differences in physical activity between groups were negligible. Of individuals who responded, 27.6% of non-Hispanic blacks, 26.5% of non-Hispanic whites, 25.7% of Hispanics, and 25.1% of other race and ethnicity reported completing 20 minutes or more of physical activity three times per week.⁽⁶⁾

Figure 18: Overweight and Obese Adults, Indiana and United States, 2008



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.
 Overweight: BMI 25.0 – 29.9 and obese: BMI \geq 30.
 Source: Indiana 2008 BRFSS Data

Obesity is developing at earlier ages. The increase in childhood obesity is now being accompanied by a rapid increase in type 2 diabetes in children and adolescents. Twenty years ago, type 2 diabetes was a disease of the middle and late years of life. Now, among some populations, type 2 is almost as prevalent as type 1 in children and adolescents.⁽²⁾ The Youth Risk Behavior System (YRBS) was developed in 1990 to monitor priority health risk behaviors that contribute to the leading causes of death, disability, and social problems among youth (9th through 12th grades) in the United States. In 2003, 12% of 9th–12th graders were overweight which increased to 15% in 2005 and decreased in 2007 to 14% (Figure 22). In 2007, 44% of high school-aged adolescents reported that they were physical active, a statistically significant increase from 32% in 2005 (Figure 23). In 2007, 29% reported watching three or more hours of television a day which was a statistically significant decrease from 32% in 2005.⁽¹²⁾

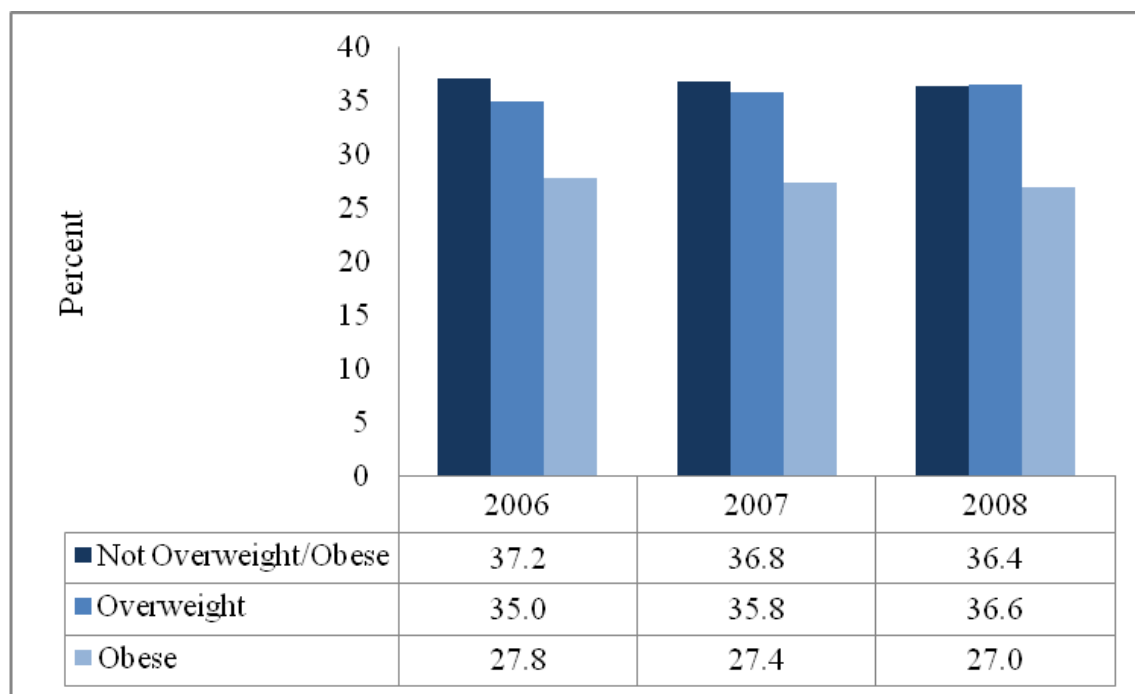
Nutritional factors also play a role, yet their role is more uncertain because of the difficulty of collecting accurate dietary data. High total calorie and low dietary fiber intake, high glycemic load and low polyunsaturated to saturated fat ratio may lead to type 2 diabetes. Data on food intake in Indiana residents are limited. However in 2007,

- *14% of Indiana's 9th -12th graders are overweight or obese.*
- *56% of Indiana's 9th-12th graders are physically inactive.*
- *29% watch three or more hours of television each day.*

- *More than 80% Indiana adults with type 2 diabetes are overweight or obese.*
- *64% of Indiana adults are overweight or obese.*
- *Only 10% of Indiana adults with diabetes are physically active.*
- *Only, 24% of Indiana adults eat fruits or vegetables five or more times a day*

only 24.3% of adults reported that they consumed fruits or vegetables five or more times a day.⁽⁶⁾

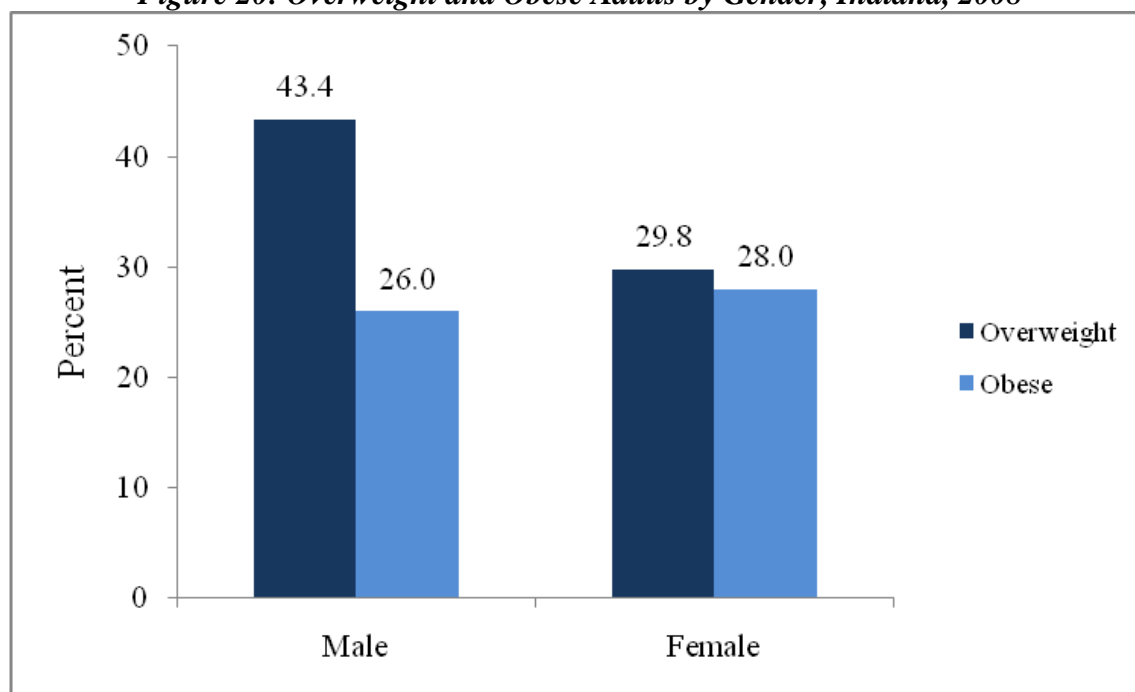
Figure 19: Overweight and Obese Adults, Indiana, 2006-2008



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older. Normal is defined as BMI < 24.9, overweight as BMI 25.0 – 29.9 and obese as BMI ≥ 30.

Source: Indiana 2006-2008 BRFSS Data

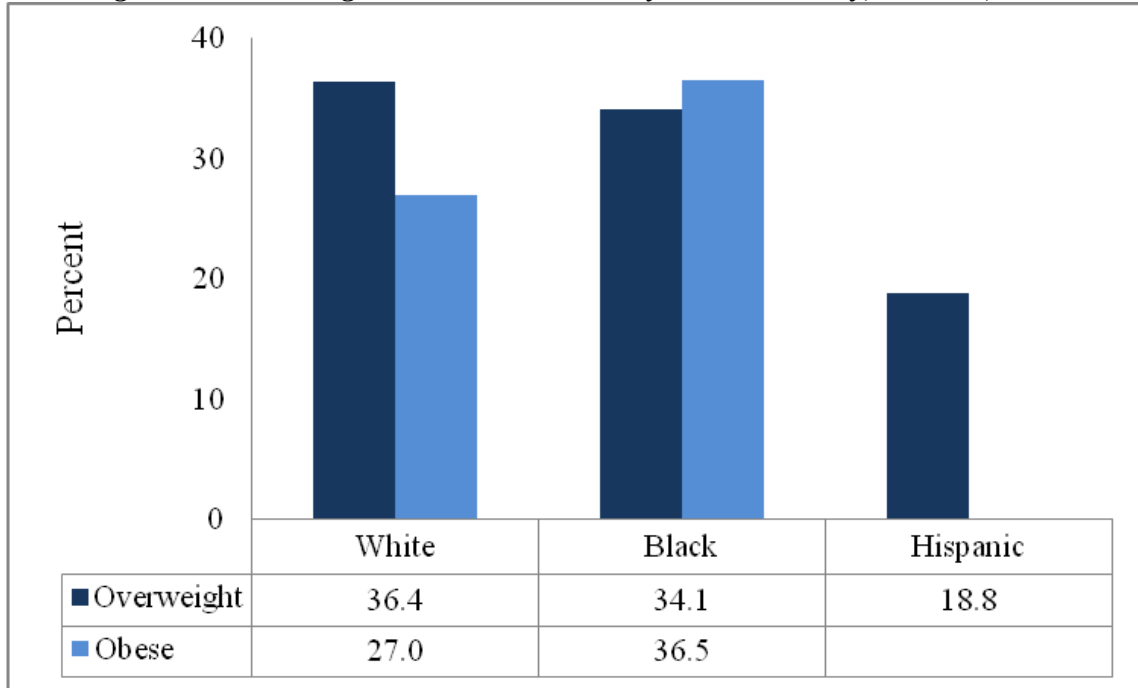
Figure 20: Overweight and Obese Adults by Gender, Indiana, 2008



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older. Overweight: BMI 25.0 – 29.9 and obese: BMI ≥ 30.

Source: Indiana 2008 BRFSS Data

Figure 21: Overweight and Obese Adults by Race/Ethnicity, Indiana, 2008



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.

Overweight: BMI 25.0 – 29.9 and obese: BMI \geq 30.

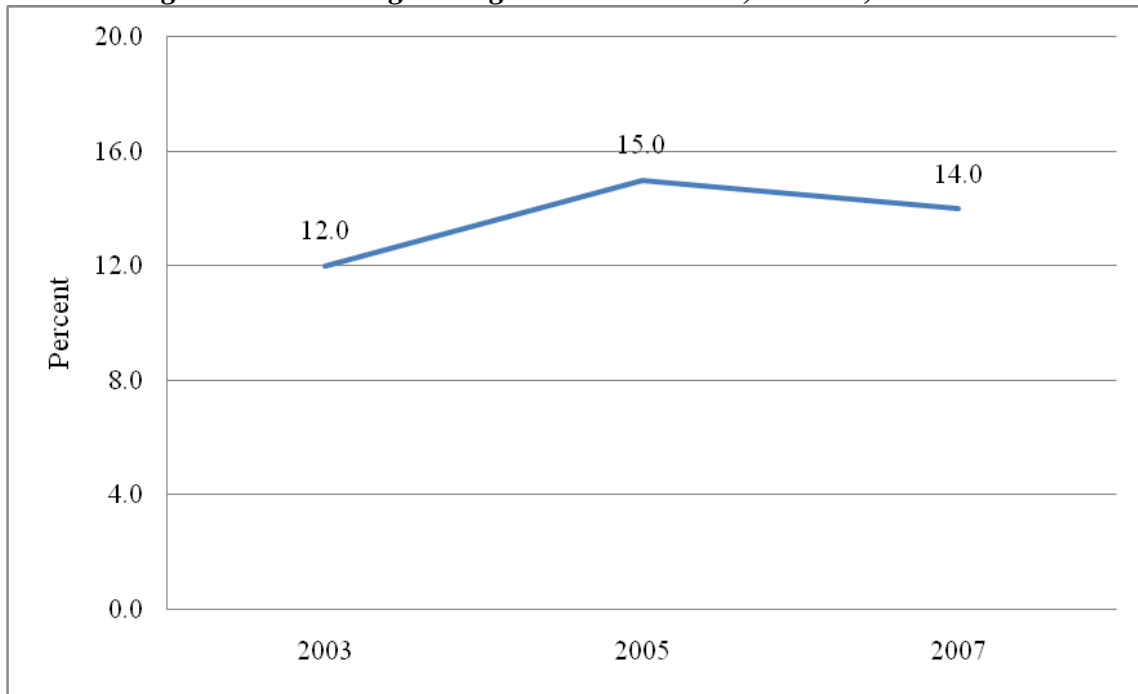
Source: Indiana 2008 BRFSS Data

Table 1: County-level Rate Estimates for Adult Diabetes and Obesity, Age Adjusted, 2007

County	Diagnosed Diabetes	Obesity	County	Diagnosed Diabetes	Obesity
Adams	8.7	28.6	Lawrence	8.9	29.0
Allen	8.5	28.5	Madison	9.1	30.2
Bartholomew	8.8	28.8	Marion	8.9	28.2
Benton	8.6	28.8	Marshall	8.3	28.1
Blackford	8.7	28.2	Martin	8.4	28.6
Boone	8.8	29.9	Miami	8.8	27.2
Brown	8.3	26.8	Monroe	7.4	26.5
Carroll	8.6	28.2	Montgomery	9.3	29.3
Cass	8.4	29.4	Morgan	8.5	28.7
Clark	9.4	29.5	Newton	8.6	28.3
Clay	8.4	29.5	Noble	8.1	29.5
Clinton	9.1	27.8	Ohio	8.7	27.8
Crawford	9.0	29.2	Orange	8.5	29.3
Daviess	8.1	28.2	Owen	8.6	29.1
Dearborn	8.4	27.2	Parke	8.3	28.2
Decatur	8.8	29.1	Perry	8.6	28.2
DeKalb	8.7	29.7	Pike	8.5	29.4
Delaware	9.6	31.4	Porter	8.6	28.1
Dubois	7.6	26.9	Posey	8.8	28.3
Elkhart	8.6	28.4	Pulaski	8.4	28.8
Fayette	8.6	28.5	Putnam	8.2	28.0
Floyd	8.7	28.5	Randolph	8.4	28.4
Fountain	8.1	28.7	Ripley	8.2	27.9
Franklin	8.5	28.2	Rush	8.3	28.9
Fulton	9.0	28.2	Scott	8.6	28.6
Gibson	8.5	28.0	Shelby	8.4	29.4
Grant	8.4	30.1	Spencer	8.5	28.5
Greene	9.1	28.2	St. Joseph	8.8	29.3
Hamilton	7.7	24.4	Starke	8.3	28.6
Hancock	9.2	27.8	Steuben	8.7	28.8
Harrison	8.6	28.6	Sullivan	8.2	27.7
Hendricks	8.1	27.3	Switzerland	9.2	28.5
Henry	8.7	29.8	Tippecanoe	7.9	27.8
Howard	8.7	27.9	Tipton	8.8	28.4
Huntington	8.6	30.1	Union	8.2	28.8
Jackson	8.5	30.0	Vanderburgh	8.2	27.3
Jasper	8.1	28.4	Vermillion	8.6	30.1
Jay	8.5	30.4	Vigo	8.7	30.8
Jefferson	8.2	31.2	Wabash	8.2	28.9
Jennings	8.3	29.3	Warren	9.0	29.3
Johnson	8.1	27.3	Warrick	8.3	28.3
Knox	8.3	28.3	Washington	8.7	28.0
Kosciusko	8.3	28.5	Wayne	8.6	27.3
LaGrange	8.7	27.7	Wells	8.1	29.5
Lake	9.9	32.1	White	8.3	28.7
LaPorte	9.7	29.2	Whitley	8.5	28.8

Source: CDC, 2007 BRFSS Data

Figure 22: Overweight* High School Students, Indiana, 2003-2007



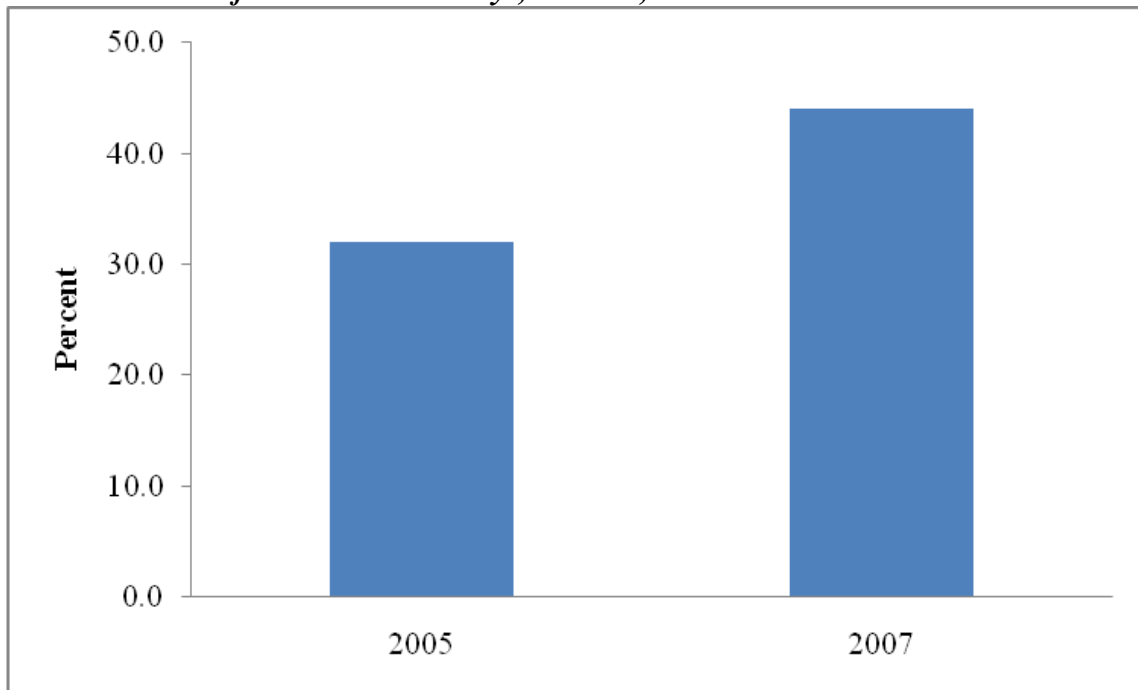
*At or above the 95th percentile for body mass index, by age and gender. The body mass index is calculated based upon self reported weight and height data.

Percentages are weighted to population characteristics. Survey was asked of individuals in 9th through 12th grades.

Overweight: BMI 25.0 – 29.9.

Source: Indiana 2003, 2005, 2007 YRBS Data

Figure 23: High School Students who were physically active for 60 Minutes on at Least Five of the Past Seven Days, Indiana, 2005 & 2007



Percentages are weighted to population characteristics. Survey was asked of individuals in 9th through 12th grades.

Source: Indiana 2005 & 2007 YRBS Data

Complications

Diabetes is a complex chronic disease, which often leads to serious complications. While most diabetes complications impact quality of life, several can lead to pre-mature mortality. However, diabetes can lead to death even in those who have not developed complications. Cardiovascular complications are the leading cause of mortality and long-term morbidity for individuals with diabetes. Diabetes is a leading cause of blindness, kidney disease, and lower extremity amputations.

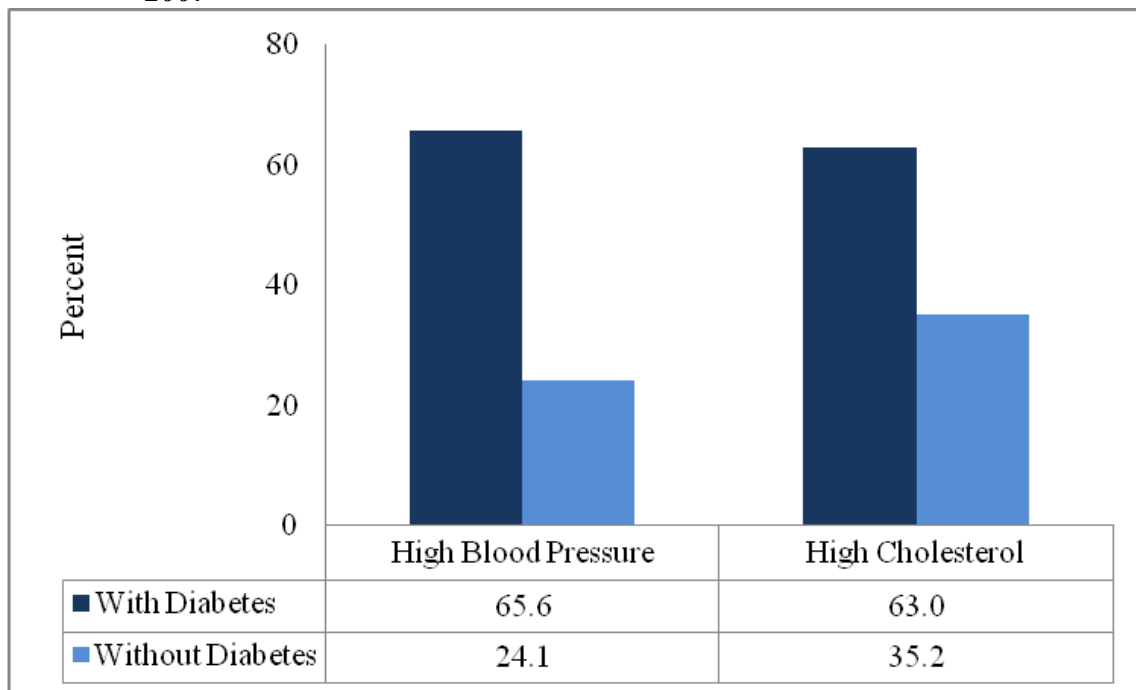
Cardiovascular Complications

High blood pressure and high cholesterol lead to coronary artery disease (heart disease), myocardial infarction (heart attack), and stroke. Heart disease and stroke account for about 65% of deaths in individuals with diabetes. Adults with diabetes are two to four times more likely to die of heart disease than adults without diabetes, and they are two to four times more at risk of having a stroke.⁽²⁾

Complications of Diabetes

- *Heart disease*
- *Stroke*
- *High blood pressure*
- *Blindness (retinopathy)*
- *Kidney disease*
- *Nerve damage (Neuropathy)*
- *Dental disease*
- *Impotence*
- *Depression*
- *Pregnancy complications*
- *Susceptibility to infection*
- *Poor wound healing*

Figure 24: High Blood Pressure and High Cholesterol by Diabetes Prevalence, Indiana, 2007



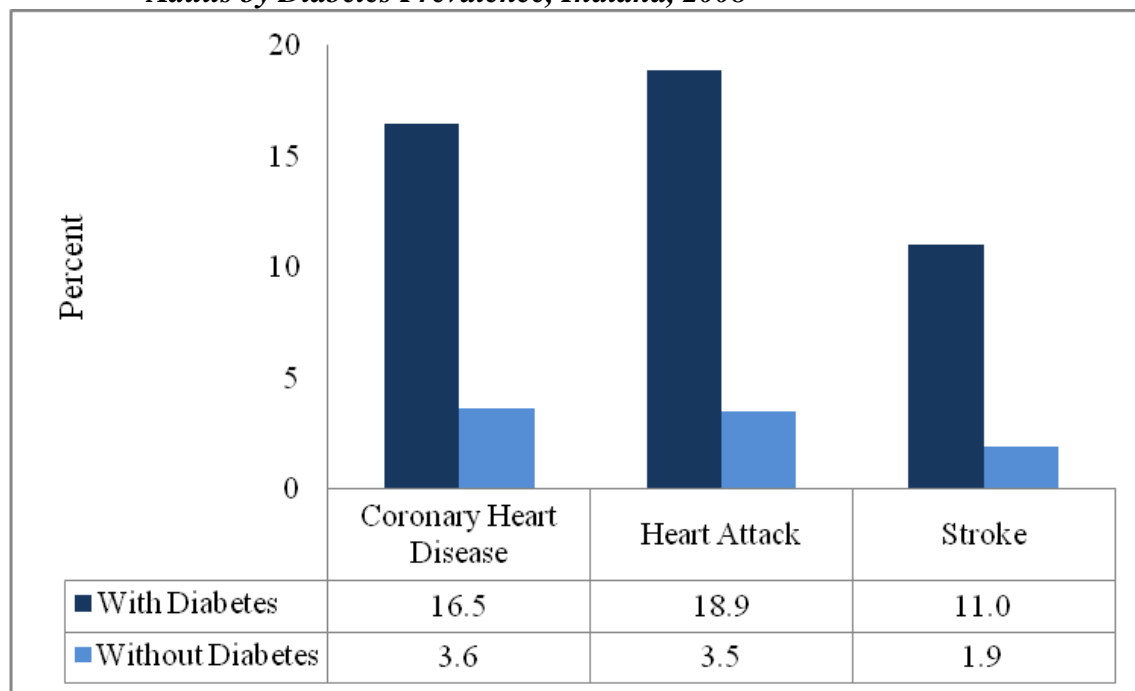
Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.

Questions: "Have you ever been told by a doctor, nurse, or other health professional that you have high blood pressure?" and "Have you ever been told by a doctor, nurse, or other health professional that your blood cholesterol is high?"

Source: Indiana 2007 BRFSS Data

In 2007, 65.6% (n=260,000) of adults in Indiana with diabetes had hypertension (high blood pressure) (Figure 24), and 92.8% were taking medication for it. Sixty-three percent (n=235,000) adults with diabetes reported having high cholesterol. In 2008, approximately 16.5% (n=70,000) of adults with diabetes reported ever being told they had coronary artery disease/angina compared to 3.6% of adults without diabetes. Almost 18.9% reported having ever having a myocardial infarction compared to 3.5% of adults without diabetes and 11.0% reported ever having had a stroke compared to 1.9% of adults without diabetes (Figure 25).⁽⁶⁾

Figure 25: Prevalence of Coronary Artery Disease, Myocardial Infarction, and Stroke in Adults by Diabetes Prevalence, Indiana, 2008



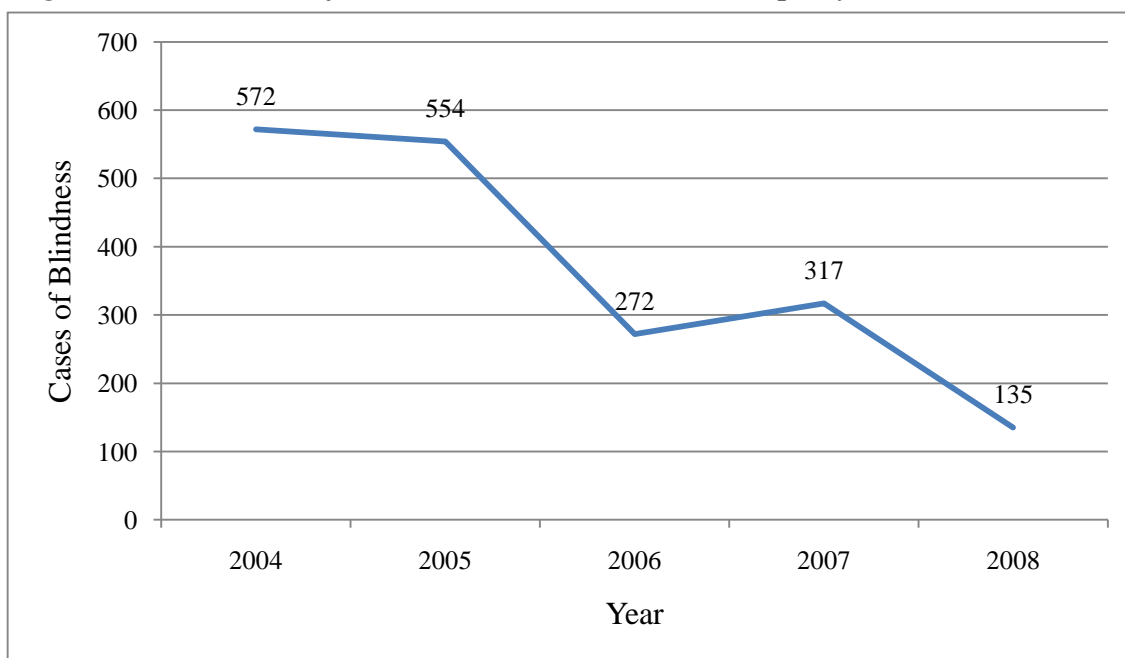
Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older. Questions: “Has a doctor, nurse, or other health professional ever told you that you any of the following? Heart attack also called a myocardial infarction, Angina or coronary artery disease, or Stroke”.
Source: Indiana 2008 BRFSS Data

Blindness and Visual Impairment

High blood glucose and high blood pressure cause small blood vessels to swell and leak liquid into the retina of the eye, which blurs vision and may lead to blindness. Diabetes is the leading cause of new cases of blindness among adults 20–74 years of age. Diabetic retinopathy is the cause for 12,000–24,000 new cases of blindness every year in the United States.⁽²⁾

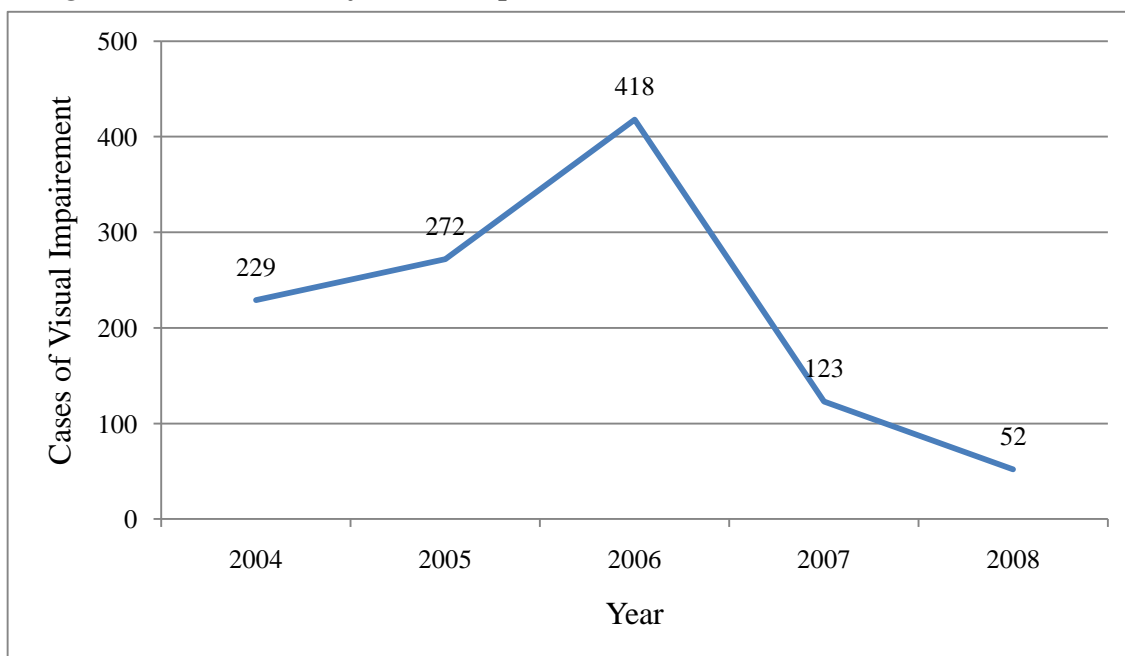
In 2008 there were 135 new cases of legal blindness among Indiana adults aged 17 and older. (Figure 26) and 52 new cases of visual impairment due to diabetic retinopathy (Figure 27) added to the Indiana Blind Registry.⁽¹³⁾ In 2008, 20.0% of Indiana adults with diabetes reported that they had retinopathy or that their diabetes had affected their eyes (Figure 28).⁽⁶⁾

Figure 26: New Cases of Blindness due to Diabetic Retinopathy, Indiana, 2004-2008



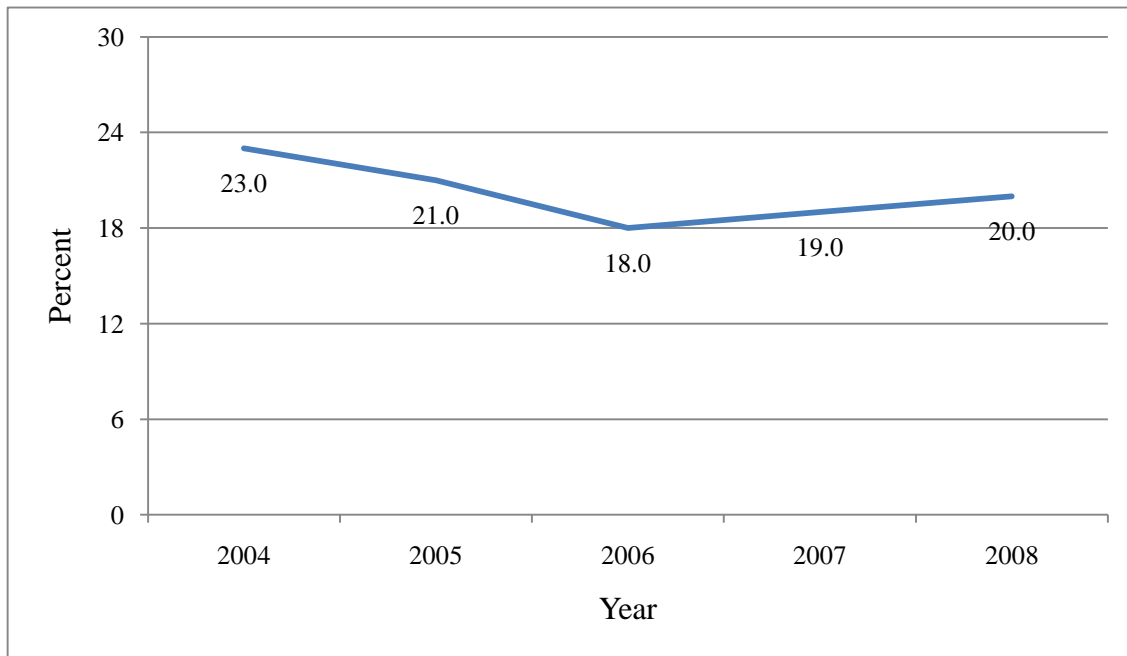
Source: Indiana Blind Registry 2004–2008 Data

Figure 27: New Cases of Visual Impairment due to Diabetes, Indiana, 2004-2008



Source: Indiana Blind Registry 2004–2008 Data

Figure 28: Percentage of Adults with Diabetes with Retinopathy, Indiana, 2004-2008



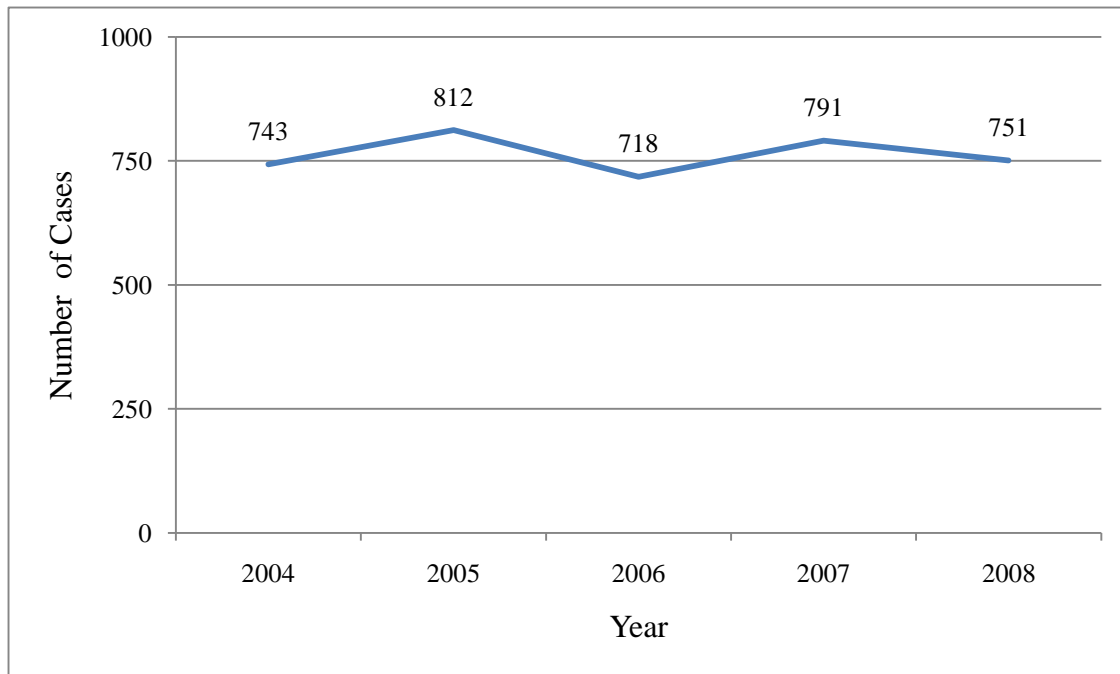
Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.
Question: "Has a doctor ever told you that diabetes has affected your eyes or that you had retinopathy?"
Source: Indiana 2004-2008 BRFSS Data

Kidney Failure

In kidney disease, cells and blood vessels in the kidneys are damaged which affect the organ's ability to filter out waste. When these organs fail or operate inefficiently, waste accumulates in the blood. In the presence of kidney failure, the contaminated blood typically needs to be filtered through a machine (dialysis), or a kidney transplant may become necessary.

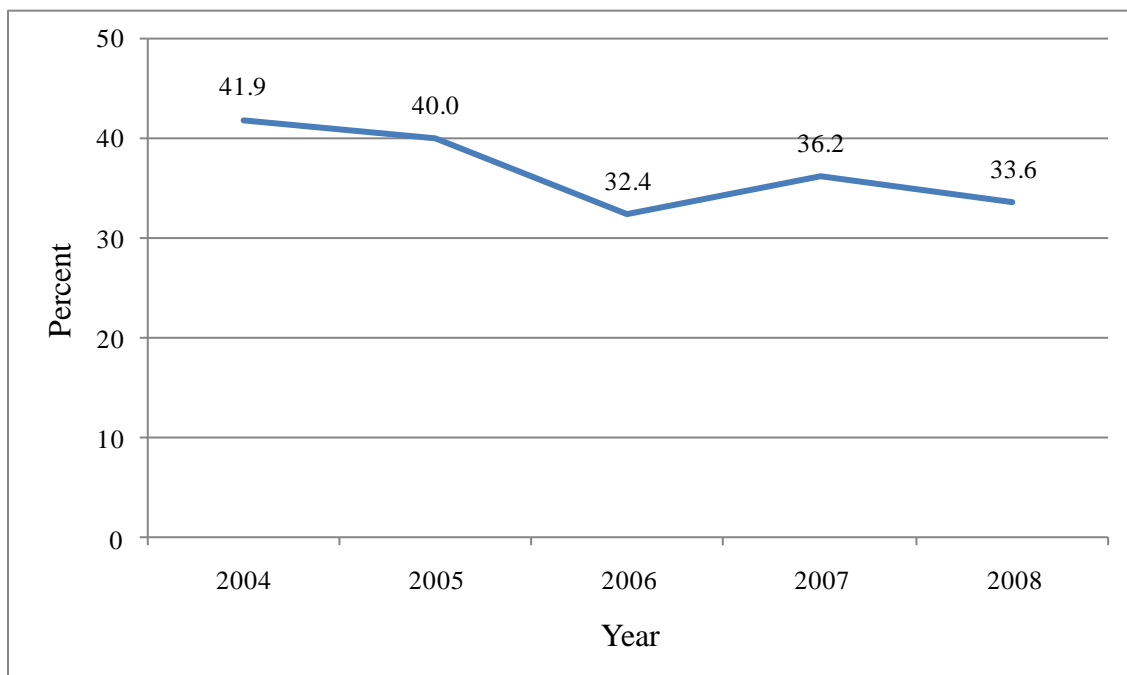
In 2008 751 of the 2,234 new cases of end stage renal disease (ESRD) were in individuals with diabetes (Figure 29) in Indiana. This accounted for 33.6% of all ESRD incident cases (Figure 30). While it appears the incidence has decreased in the past few years, the prevalence continues to rise. In 2008 there were 6,688 prevalent cases of end stage renal disease, of which 2706 involved diabetic individuals (Figure 31). This represented 40.4% of all ESRD cases (Figure 32). Eighty-one individuals with diabetes-related kidney failure received a kidney transplant in 2006 (Figure 33). The number of individuals with diabetes receiving kidney transplants has doubled since 1995.⁽¹⁴⁾

Figure 29: New Cases of Diabetes-Related End-Stage Renal Disease, Indiana, 2004-2008



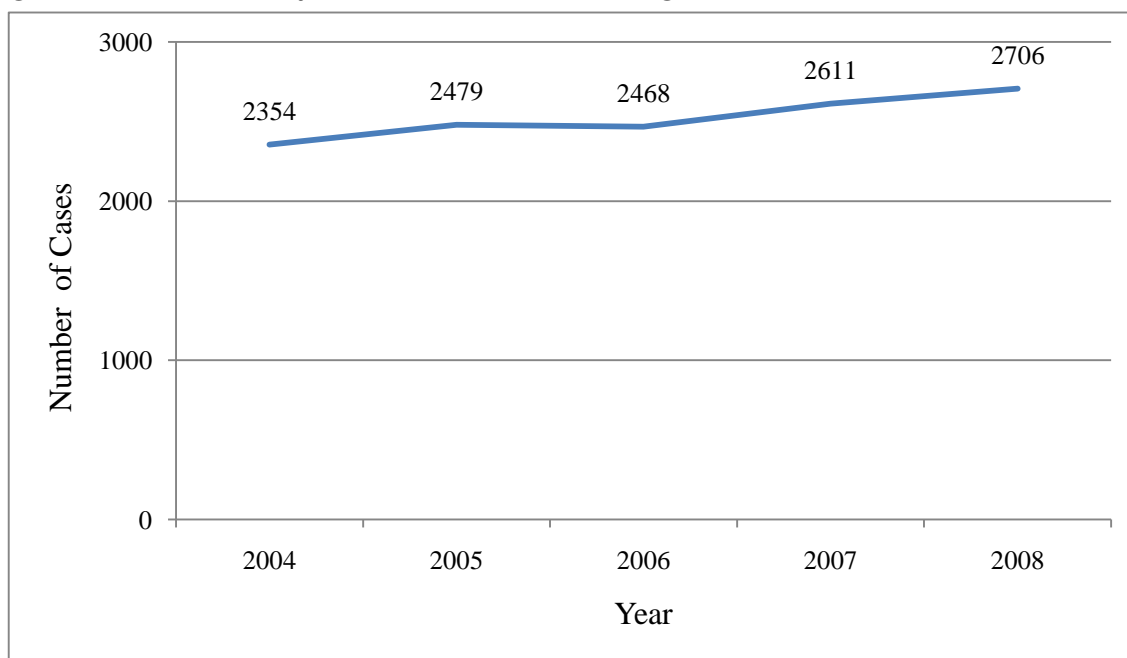
Source: The Renal Network 2004–2008 Data

Figure 30: Percentage of New End-Stage Renal Disease Patients who have Diabetes, Indiana, 2004-2008



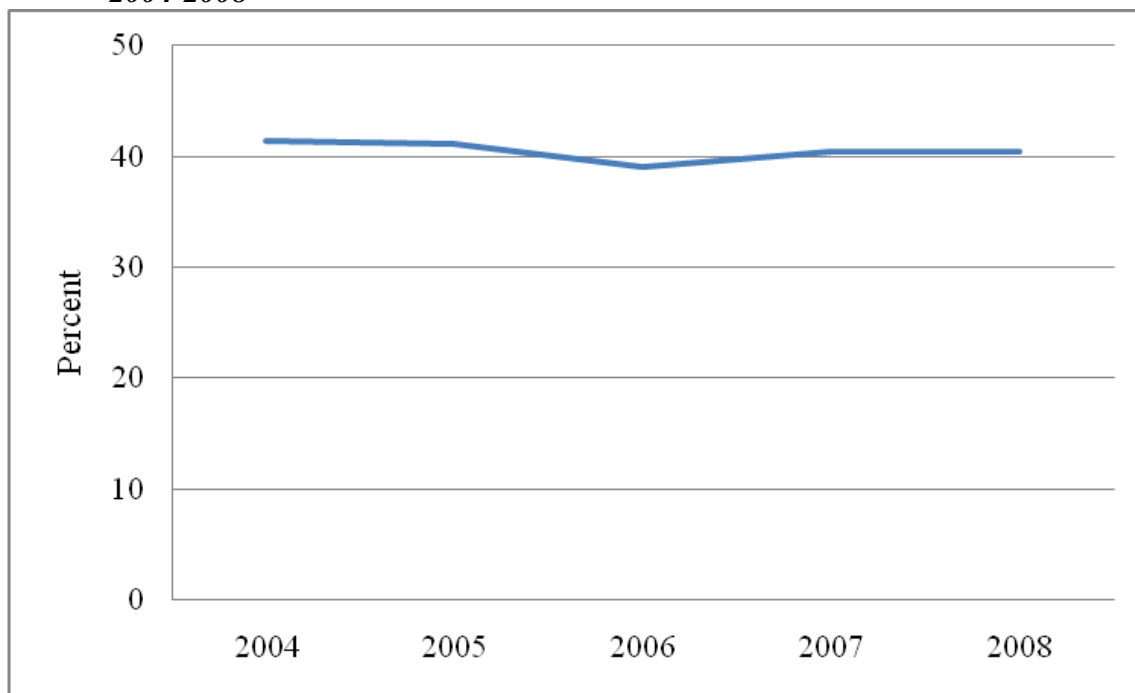
Source: The Renal Network 2004–2008 Data

Figure 31: Prevalence of Diabetes-Related End-Stage Renal Disease, Indiana, 2004-2008



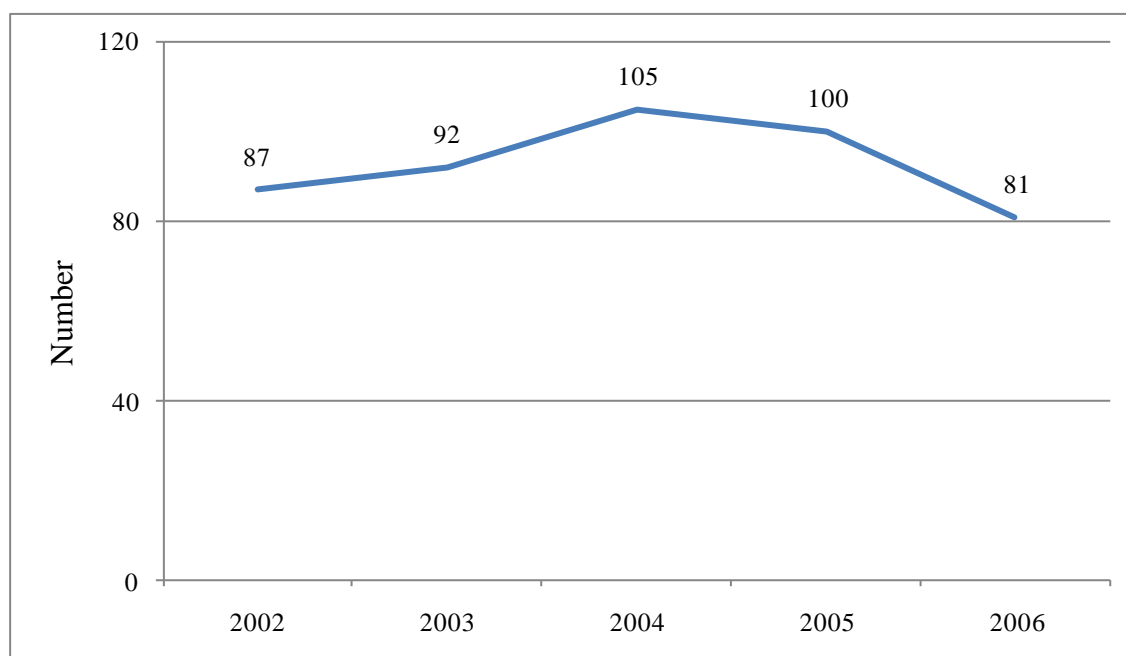
Source: The Renal Network 2004–2008 Data

Figure 32: Percentage of All End-Stage Renal Disease Patients who have Diabetes, Indiana, 2004-2008



Source: The Renal Network 2004–2008 Data

Figure 33: Adult Kidney Transplants due to Diabetes-Related Damage, Indiana, 2002-2006



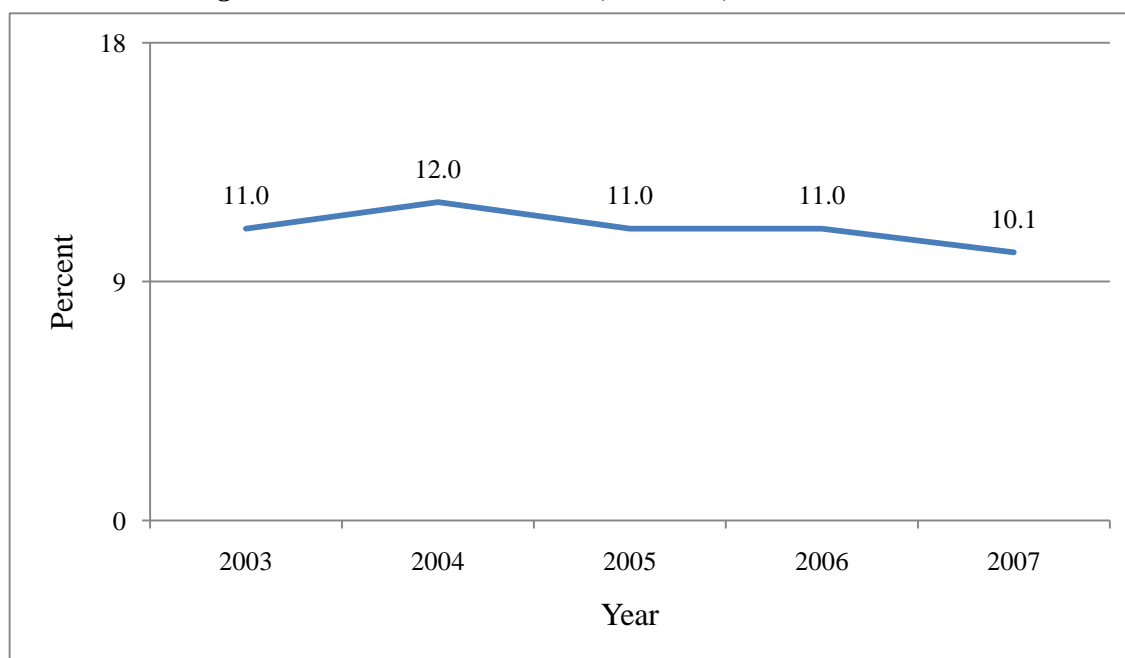
Source: The Renal Network 2002–2006 Data

Nerve Damage and Amputations

Having high blood glucose in the body for several years can damage the blood vessels that carry oxygen and other nutrients to nerves. Over time this can lead to nerve damage. Nerve damage caused by diabetes is called diabetic neuropathy and results in impaired sensation or pain in the feet or hands, slowed digestion of food, carpal tunnel syndrome, and other nerve problems. Approximately 60–70% of individuals with diabetes experience mild to severe forms of neuropathy. The most common form is known as peripheral neuropathy, which affects the extremities. Almost 30% of individuals who are over 40 years of age and are diabetic have impaired sensation in their feet. Severe forms of nerve disease can lead to amputations with more than 60% of non-traumatic lower extremity amputations occurring in individuals with diabetes. Amputations can be a result of ulcers developing on the feet when there is no sensation to warn the individual that damage is occurring. Amputations can also result from poor circulation due to blood vessel damage.⁽²⁾

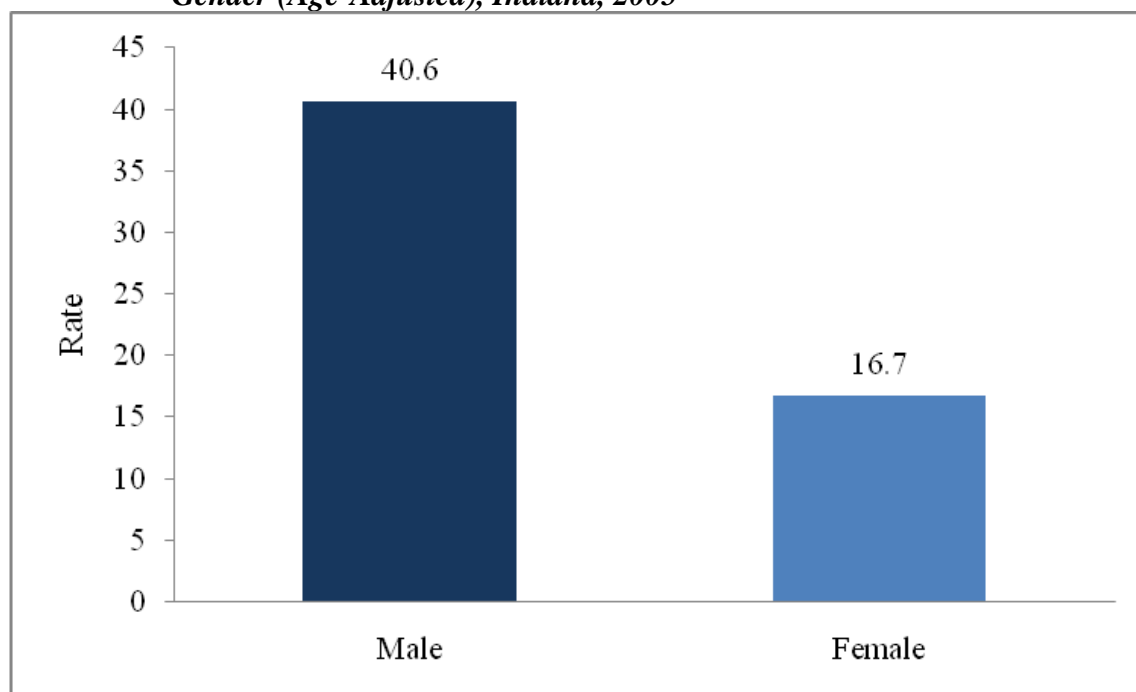
According to the 2007 Indiana BRFSS data, 10.1% of adults with diabetes reported having sores or irritation on their feet that took more than four weeks to heal (Figure 34). If circulation becomes progressively worse, lower extremity amputation may be necessary. In 2005, among Indiana residents hospitalized with a primary discharge diagnosis of diabetes, 1,763 individuals underwent a lower extremity amputation. Of those individuals who had an amputation, 598 were female (16.7 per 100,000), and 1,165 were male (40.6 per 100,000) (Figure 35). Figure 36 shows the racial/ethnic breakdown for lower extremity amputation. There were 1,229 amputations in the non-Hispanic white population (20.8 per 100,000) and 274 in the non-Hispanic black population (66.3 per 100,000). Non-Hispanic black males had the highest rate (92.8 per 100,000), followed by non-Hispanic black females (45.4 per 100,000), non-Hispanic white males (30.9 per 100,000), and non-Hispanic white females (12.5 per 100,000) (Figure 37).⁽¹⁵⁾

Figure 34: Adults with Diabetes who had Sores or Irritations on Their Feet that took Longer than Four Weeks to Heal, Indiana, 2003-2007



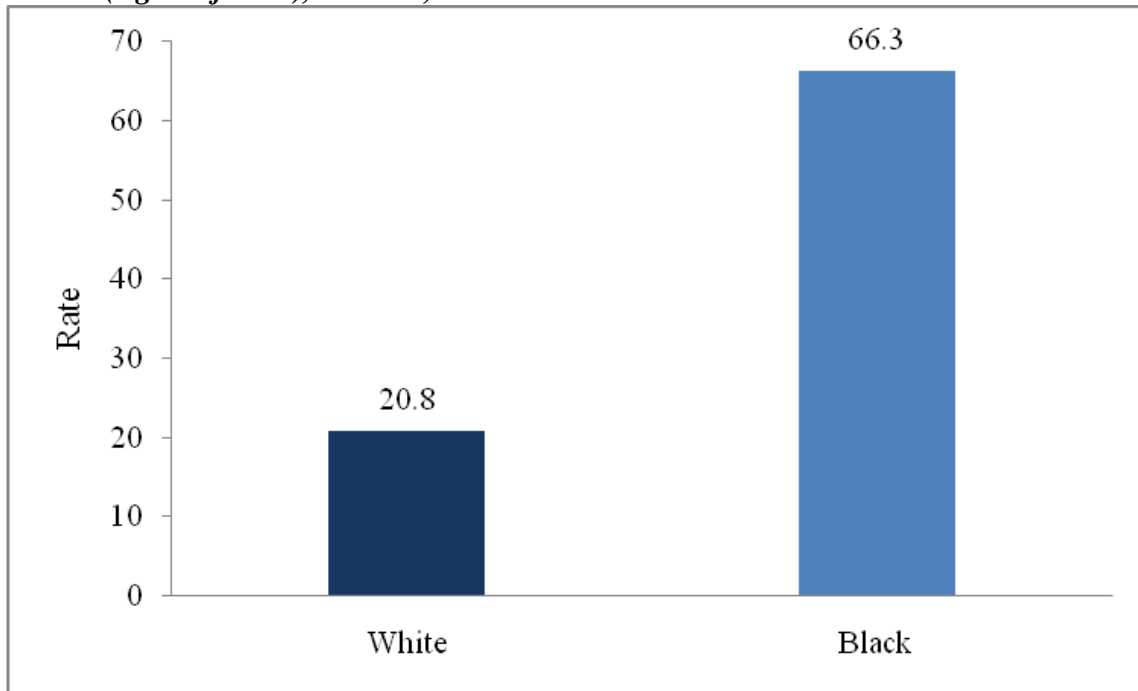
Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.
 Question: "Have you ever had any sores or irritations on your feet that took more than four weeks to heal?"
 Source: Indiana 2003-2007 BRFSS Data

Figure 35: Rate (per 100,000) of Diabetes-Related Lower Extremity Amputations by Gender (Age-Adjusted), Indiana, 2005



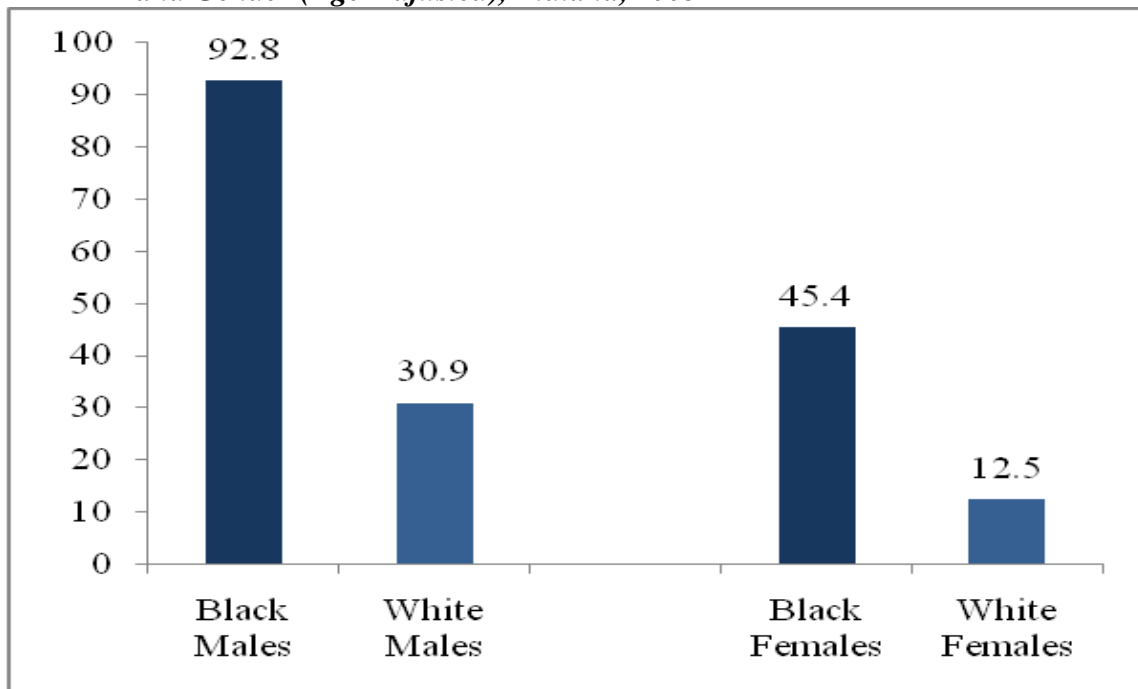
Source: Indiana Inpatient Hospital Discharge 2005 Data

Figure 36: Rate (per 100,000) of Diabetes-Related Lower Extremity Amputations by Race, (Age-Adjusted), Indiana, 2005



Source: Indiana Inpatient Hospital Discharge 2005 Data

Figure 37: Rate (per 100,000) of Diabetes-Related Lower Extremity Amputations by Race and Gender (Age-Adjusted), Indiana, 2005



Source: Indiana Inpatient Hospital Discharge 2005 Data

Dental Disease

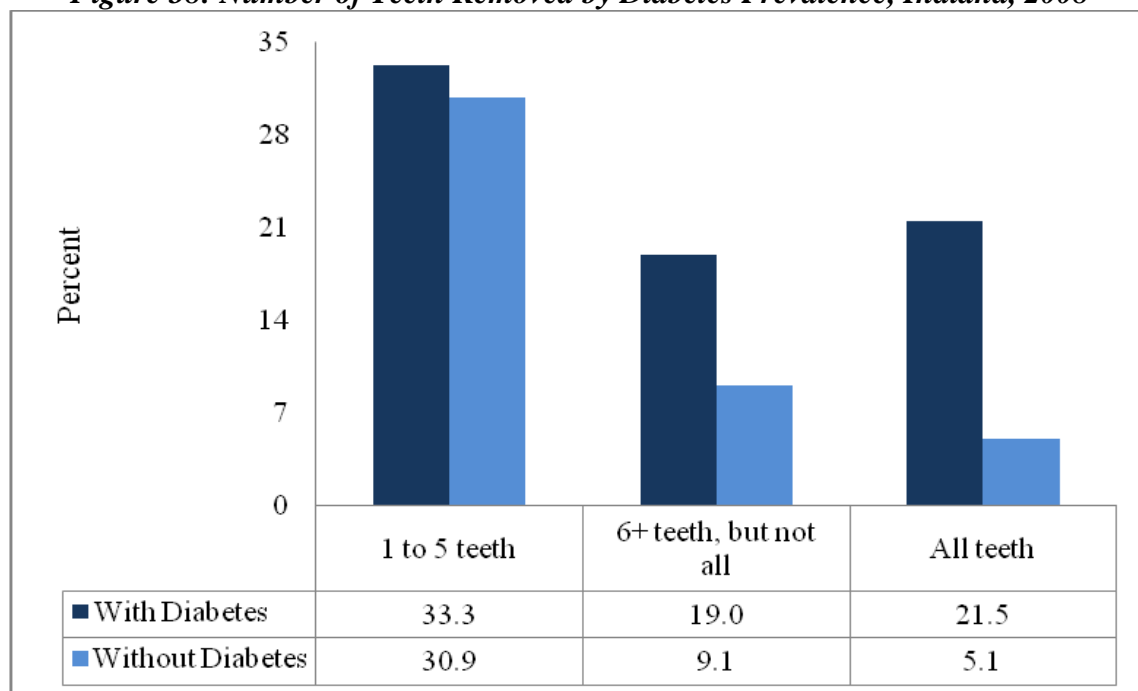
Because of high glucose levels in the blood, individuals with diabetes tend to have more health problems with their gums and teeth. Periodontal (gum) disease is more common in individuals with diabetes. Young adults with diabetes have about twice the risk of having periodontal disease than those without diabetes. Around one-third of individuals with diabetes have severe periodontal disease with loss of attachment of the gums to the teeth measuring five millimeters (about 3/8 inch) or more. Other problems include fungal infections, poor post-surgery healing, and dry mouth.⁽²⁾

In 2008, 33.3% adults with diabetes had 1-5 permanent teeth removed as opposed to 30.9% adults without diabetes. Of adults with diabetes, 19.0% had six or more (but not all) permanent teeth removed compared to the 9.1% adults without diabetes (Figure 38). Of adults with diabetes, 21.5% had all their permanent teeth removed compared to 5.1% of adults without diabetes.⁽⁶⁾

Depression

Studies show that diabetes doubles the risk of depression. The psychological stress of having diabetes as well as the metabolic effect of the disease on the brain, both play a role in causing depression. The risk of depression increases as more diabetic complications develop.⁽²⁾ In 2006, 27.6% of adults with diabetes reported that they had ever been diagnosed with depression compared to 18.7% of adults who did not have diabetes (Figure 39).⁽⁶⁾

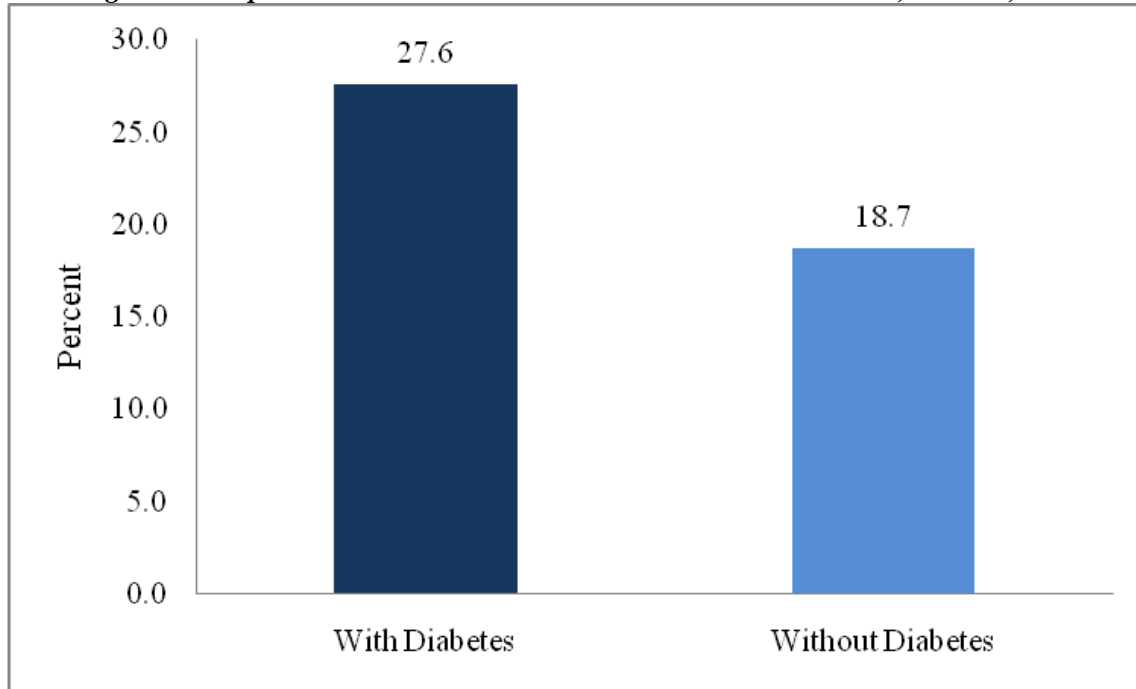
Figure 38: Number of Teeth Removed by Diabetes Prevalence, Indiana, 2008



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.
Question: "How many of your permanent teeth have been removed because of tooth decay or gum disease? Include teeth lost to infection, but do not include teeth lost for other reasons, such as injury or orthodontics."

Source: Indiana 2008 BRFSS Data

Figure 39: Depressive Disorder in Adults with and without Diabetes, Indiana, 2006



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.
Question: "Has a doctor or other healthcare provider ever told you that you have a depressive disorder including depression, major depression, dysthymia, or minor depression?"
Source: Indiana 2006 BRFSS Data

Pregnancy Complications

Poorly controlled diabetes before conception and during the first trimester of pregnancy can result in major birth defects in 5-10% of pregnancies and can cause spontaneous abortions in 15-20% of pregnancies. Uncontrolled diabetes during the second and third trimesters of pregnancy can result in excessively large babies, posing a risk to the mother and child.⁽²⁾

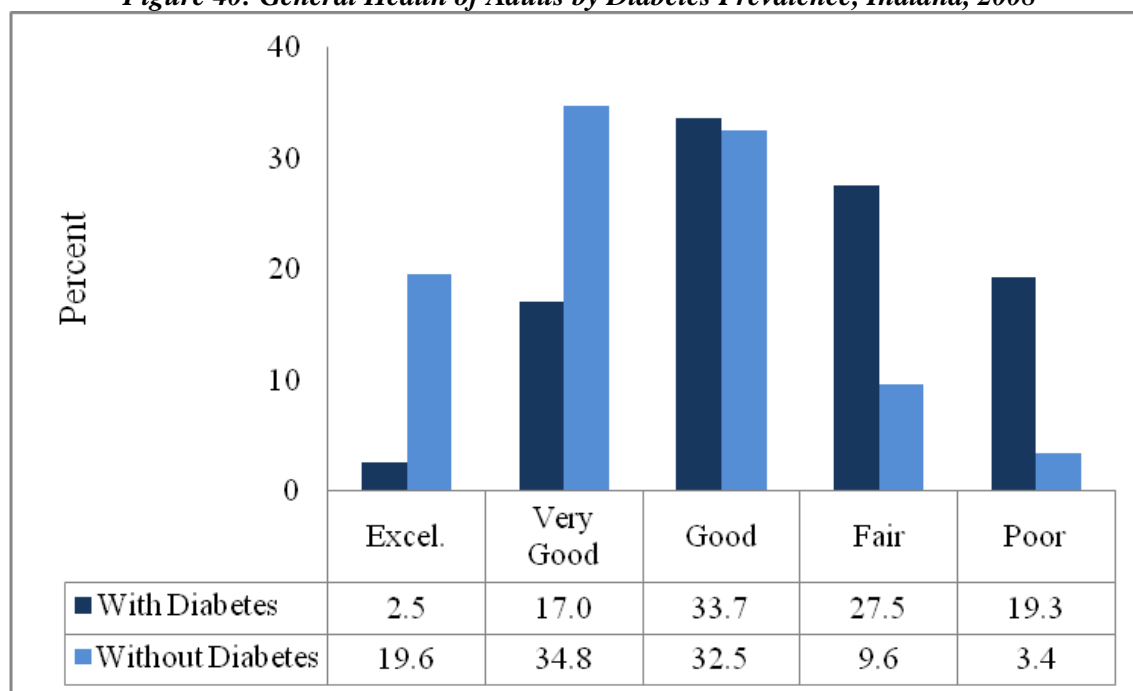
Other Complications

If diabetes is not managed, it can lead to biochemical imbalances that can cause acute life-threatening events such as diabetic ketoacidosis (DKA) and hyperosmolar (non-ketotic) coma. DKA is a state of inadequate insulin levels resulting in high blood sugar and accumulation of organic acids and ketones in the blood and is primarily seen in individuals with type 1 diabetes. It is common in DKA to have severe dehydration and significant alterations of the body's blood chemistry. DKA can lead to coma and death in some individuals. DKA is seen primarily in patients with type 1 (insulin-dependent) diabetes. The incidence is roughly 2 per 100 patient years of diabetes, with about 3% of type 1 diabetic patients initially presenting with DKA. It can occur in type 2 (non-insulin-dependent) diabetic patients as well.

Hyperglycemic hyperosmolar non-ketotic coma is characterized by severe hyperglycemia, dehydration, and altered mental status in the absence of ketosis. This condition typically occurs

in those with type 2 diabetes, particularly in older persons following a cerebral vascular accident. The national incidence is 17.5 cases per 100,000 individuals, and it accounts for 1 in 1000 hospital admissions.⁽¹⁶⁾

Figure 40: General Health of Adults by Diabetes Prevalence, Indiana, 2008



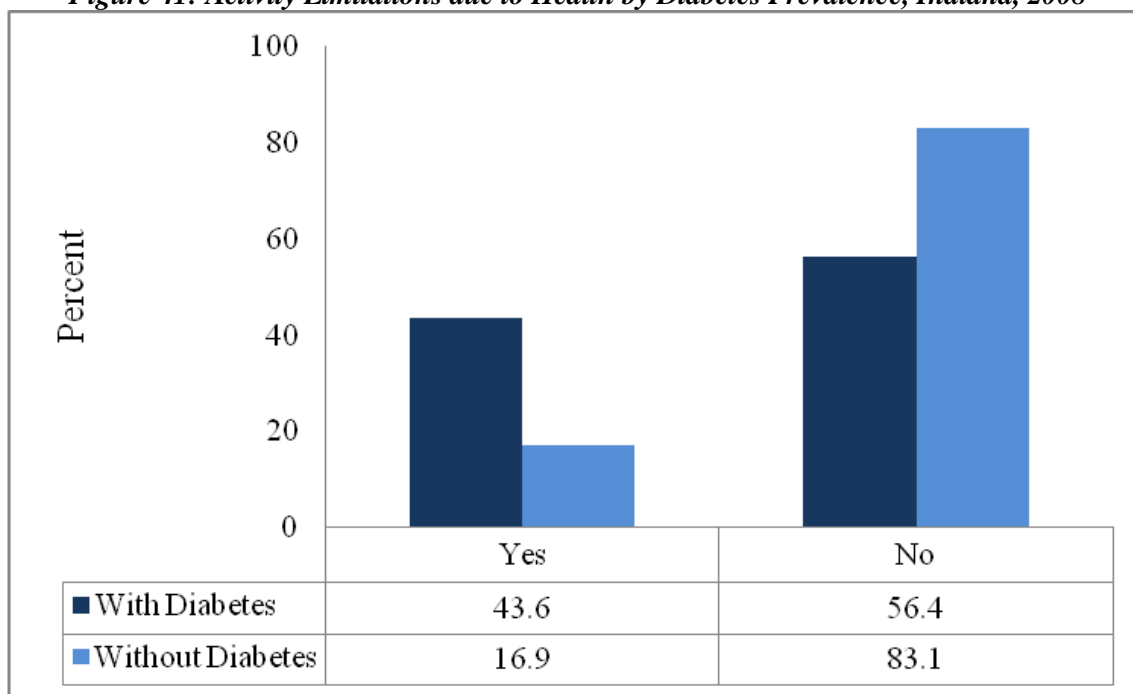
Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.

Question: "Would you say that in general your health is . . .?"

Source: Indiana 2008 BRFSS Data

Overall, individuals with poorly controlled diabetes are more susceptible to illness, and once they become sick, they often have a worse prognosis. For example, those with diabetes are more likely to be hospitalized or die because of pneumonia or influenza than individuals without diabetes.⁽²⁾ Having diabetes affects general health and daily physical activity. In 2008, almost 50% of adults with diabetes reported that, in general, their health was fair or poor (Figure 40). Very few individuals reported their health to be excellent or very good especially when compared to adults without diabetes. The status of an individual's health has a great impact on their daily activities. In 2008 more than twice as many adults with diabetes reported having activity limitations compared to those without diabetes (Figure 41).⁽⁶⁾

Figure 41: Activity Limitations due to Health by Diabetes Prevalence, Indiana, 2008



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.
 Question: "Are you limited in any way in any activities because of physical, mental, or emotional problems?"
 Source: Indiana 2008 BRFSS Data

Mortality

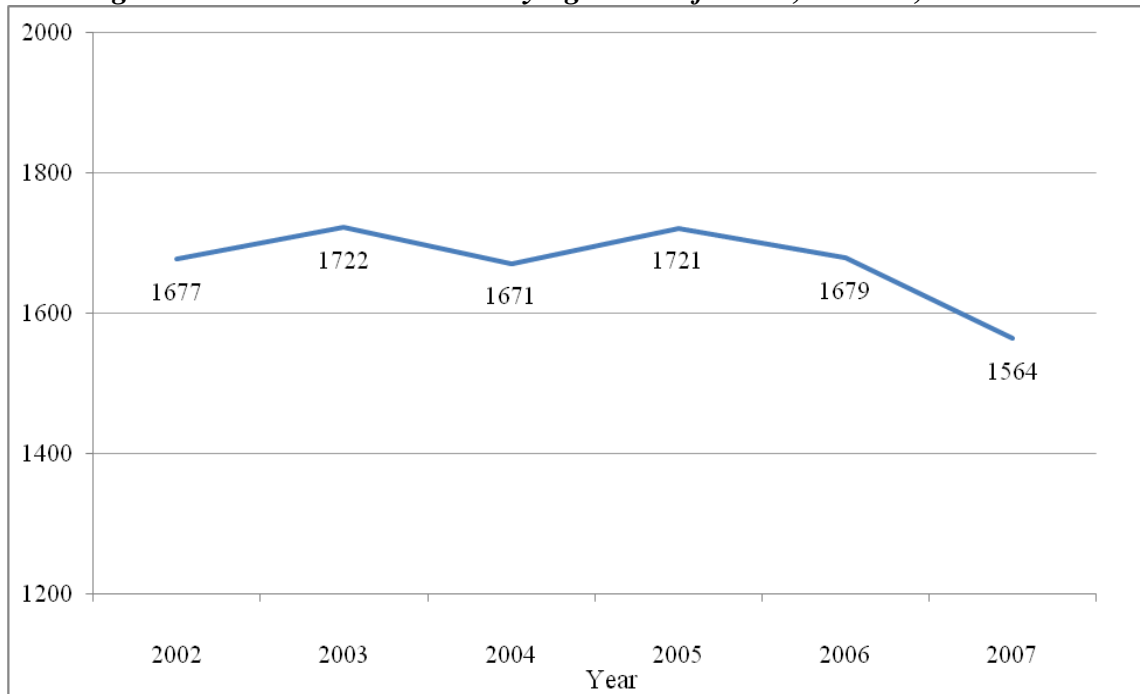
Diabetes was the seventh leading cause of death in the United States in 2006. This ranking is based on the 73,507 death certificates that identified diabetes as the underlying cause of death. According to death certificate reports, diabetes contributed to 233,619 deaths. However, this number is likely to be underreported, because studies have found that only 35-40% of decedents with diabetes had it listed anywhere on the certificate, and only 10-15% had it listed as the underlying cause of death. Those with diabetes have twice the risk for death compared to individuals of the same age who do not have diabetes.⁽²⁾ Premature mortality caused by diabetes results in an estimated 12-14 years of life lost.⁽⁵⁾

In 2007, there were 1,564 Indiana residents who died with diabetes as the underlying cause of death, making it the seventh leading cause of death (Figure 42). Diabetes was the 4th leading cause of death in residents aged 55 to 64 years, the 5th leading cause of death for those 65 years and older, and the 9th for those 25-34 years. The overall age-adjusted diabetes mortality rate for 2007 was 23.42 per 100,000 adults (Figure 43). Though the number of deaths is higher in females (837) than males (727), males have a higher mortality rate (25.9 per 100,000) than females (21.3 per 100,000) (Figures 44 and 45).⁽¹⁷⁾

In 2007, diabetes was the 4th leading cause of death for blacks, 3rd for Asian/Pacific Islanders, 7th for non-Hispanic whites, and 8th for Hispanics in Indiana. The number of deaths in the non-Hispanic white population was higher than in the non-Hispanic black population (Figure 46). However when comparing diabetes mortality rates, the non-Hispanic black rate was almost twice as high as the non-Hispanic white rate (Figure 47). The age-adjusted death rate for Hispanic individuals in 2006 was 25.74 per 100,000, but data from 2007 was not sufficient for comparable analysis. Non-Hispanic white females had the highest number of deaths from diabetes in the past five years, but when comparing rates, non-Hispanic black males and females have the highest mortality rates (Figures 48 and 49).⁽¹⁷⁾

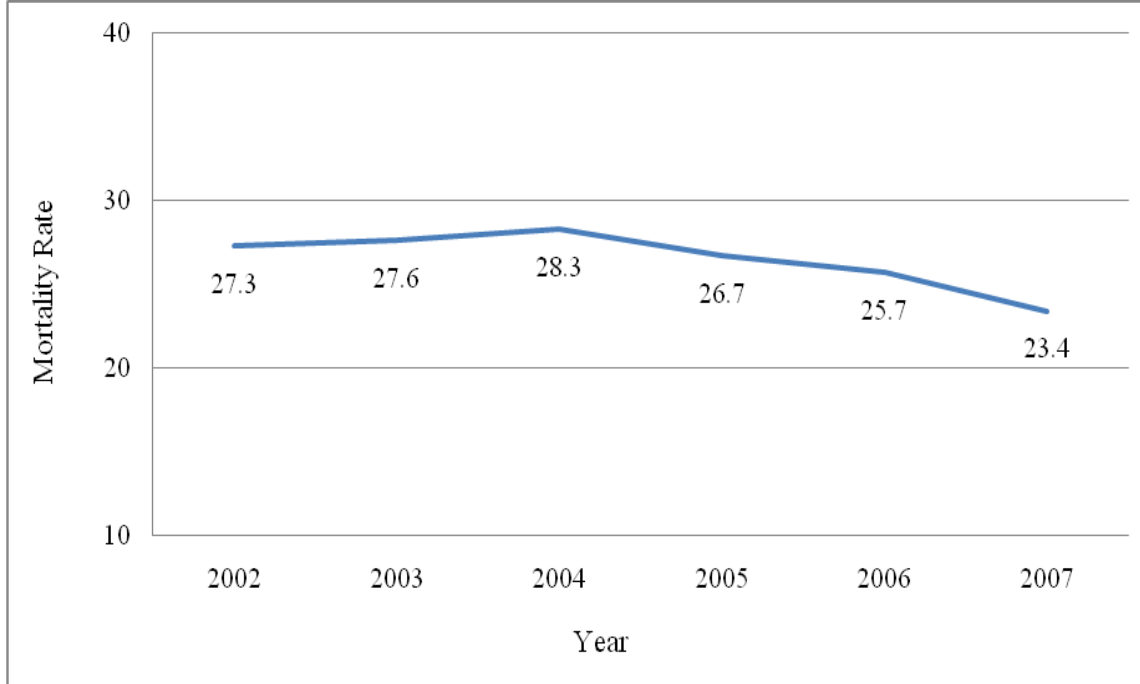
Please note that mortality data come from death certificates that list diabetes as an underlying cause of death, meaning that diabetes was the disease which initiated the chain of morbid events leading directly to death. This is just a small portion of the number of deaths where diabetes played a role. When looking at diabetes as a contributing cause of death, the number of deaths is much larger. Diabetes as a “contributing” cause of death means that diabetes was listed on the death certificate and contributed to the death but was not the main (underlying) cause of death. An example of a contributing cause of death would be if an individual with diabetes died of acute renal failure. In this scenario, diabetes did not cause the death but was a significant contributor to the death. Figure 50 shows the number of deaths for the past five years in which diabetes was a contributing cause. When the contributing cause is added to the underlying cause, the mortality burden is greater and gives a more comprehensive description of the toll of diabetes in the state.

Figure 42: Diabetes as an Underlying Cause of Death, Indiana, 2002-2007



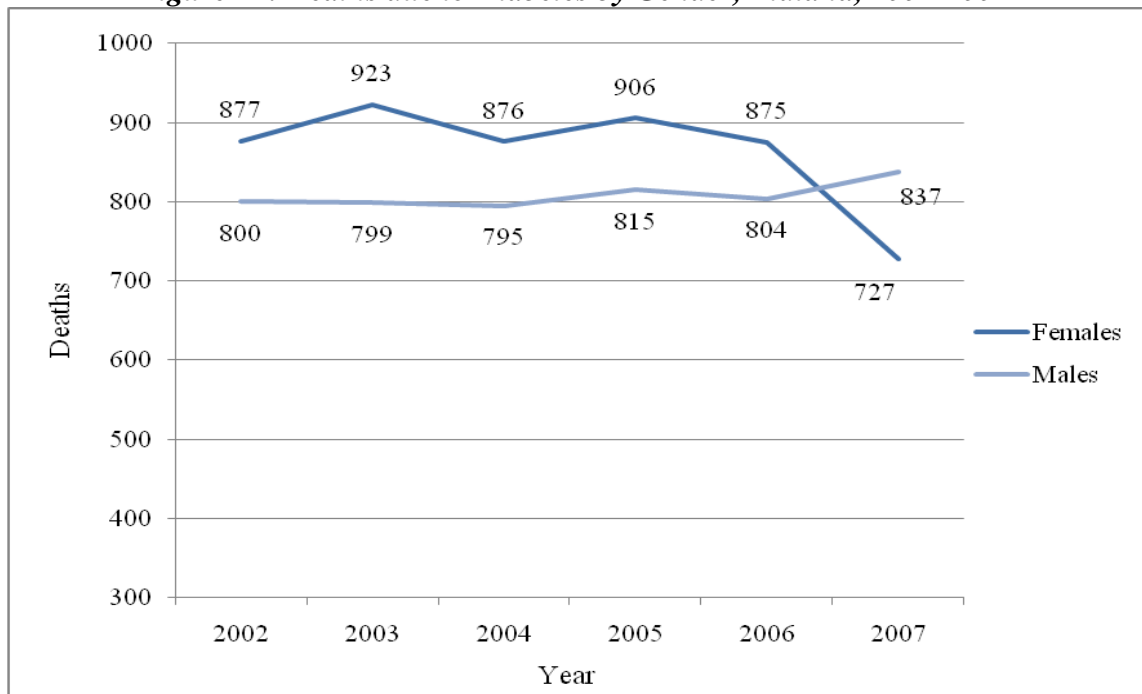
Source: Indiana State Department of Health 2002-2007 Mortality Data

Figure 43: Age –Adjusted Diabetes Mortality Rates (per 100,000), Indiana, 2002-2007



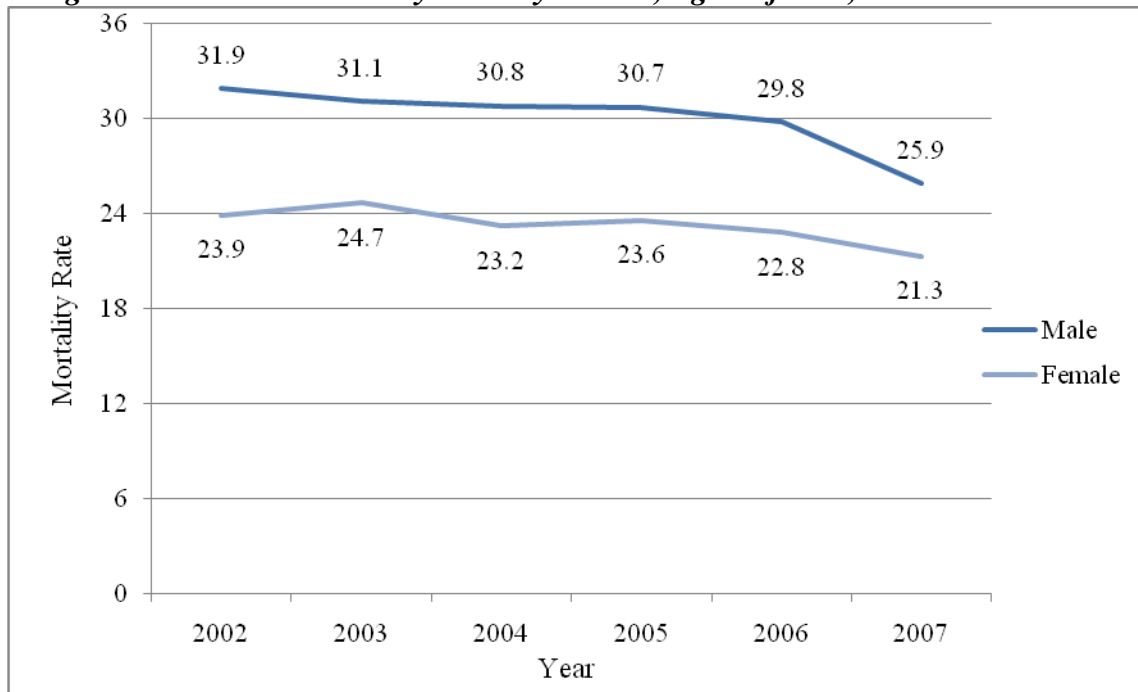
Source: Indiana State Department of Health 2002-2007 Mortality Data

Figure 44: Deaths due to Diabetes by Gender, Indiana, 2002-2007



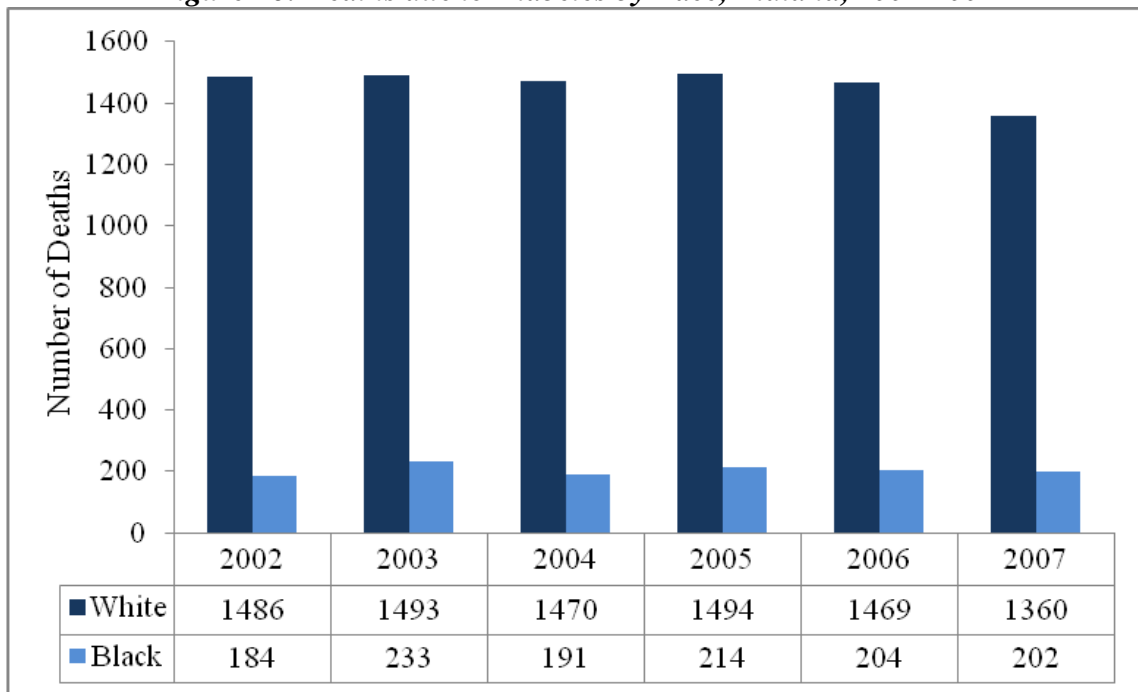
Source: Indiana State Department of Health 2002–2007 Mortality Data

Figure 45: Diabetes Mortality Rates by Gender, Age-Adjusted, Indiana 2002-2007



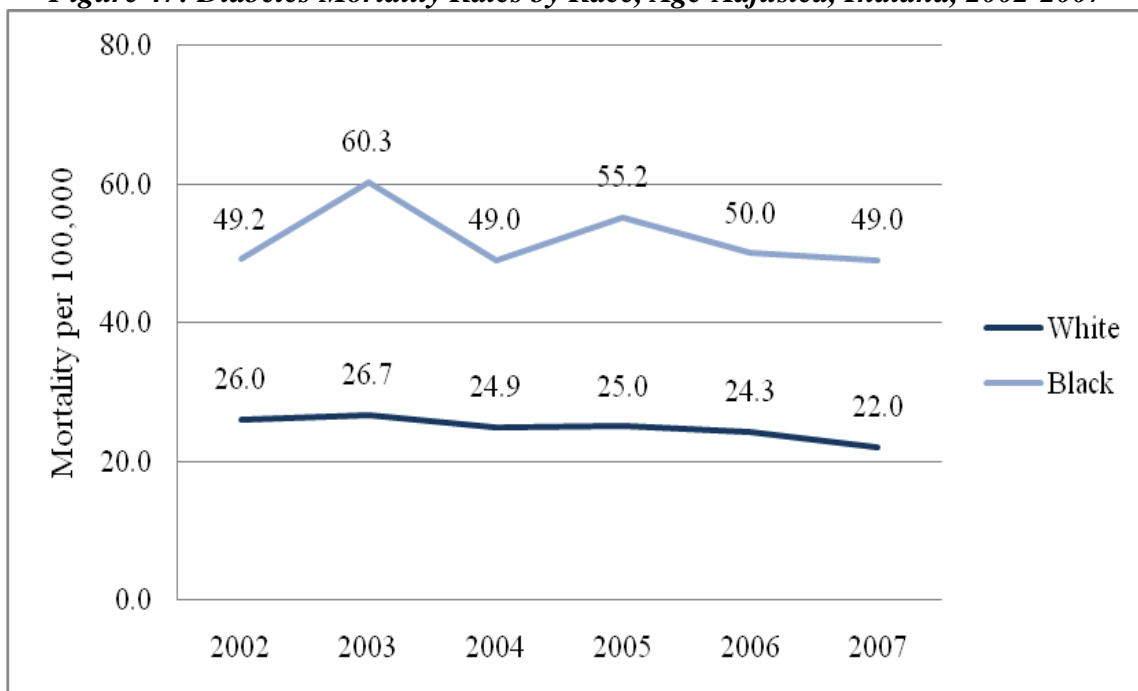
Source: Indiana State Department of Health 2002–2007 Mortality Data

Figure 46: Deaths due to Diabetes by Race, Indiana, 2002-2007



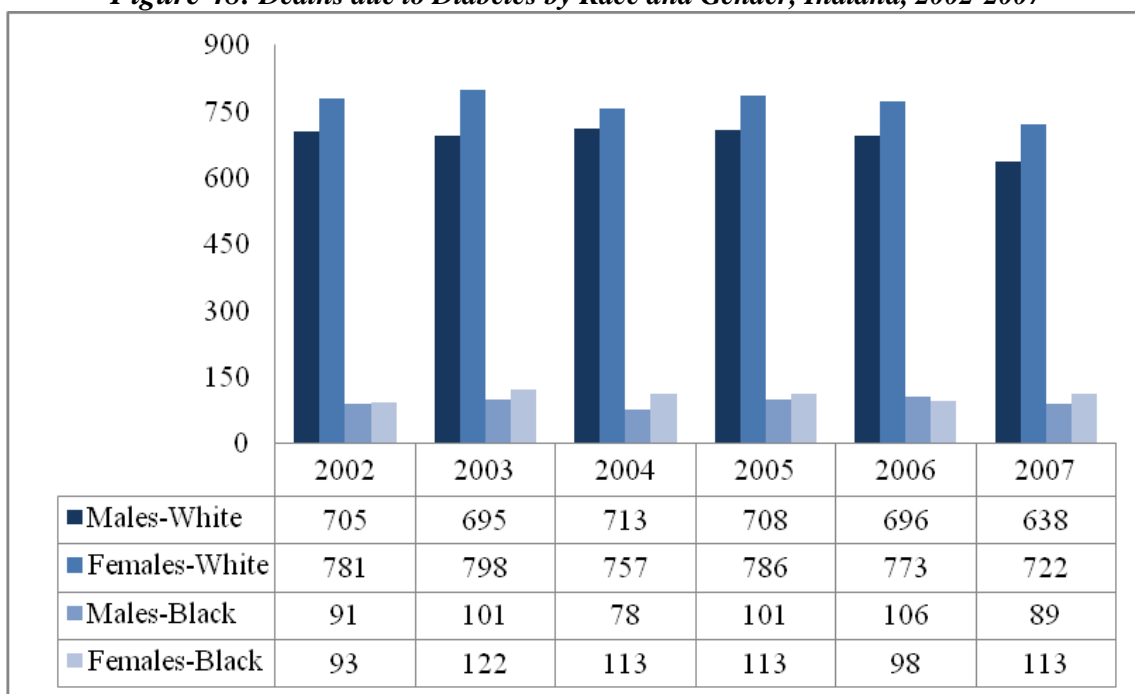
Source: Indiana State Department of Health 2002–2007 Mortality Data

Figure 47: Diabetes Mortality Rates by Race, Age-Adjusted, Indiana, 2002-2007



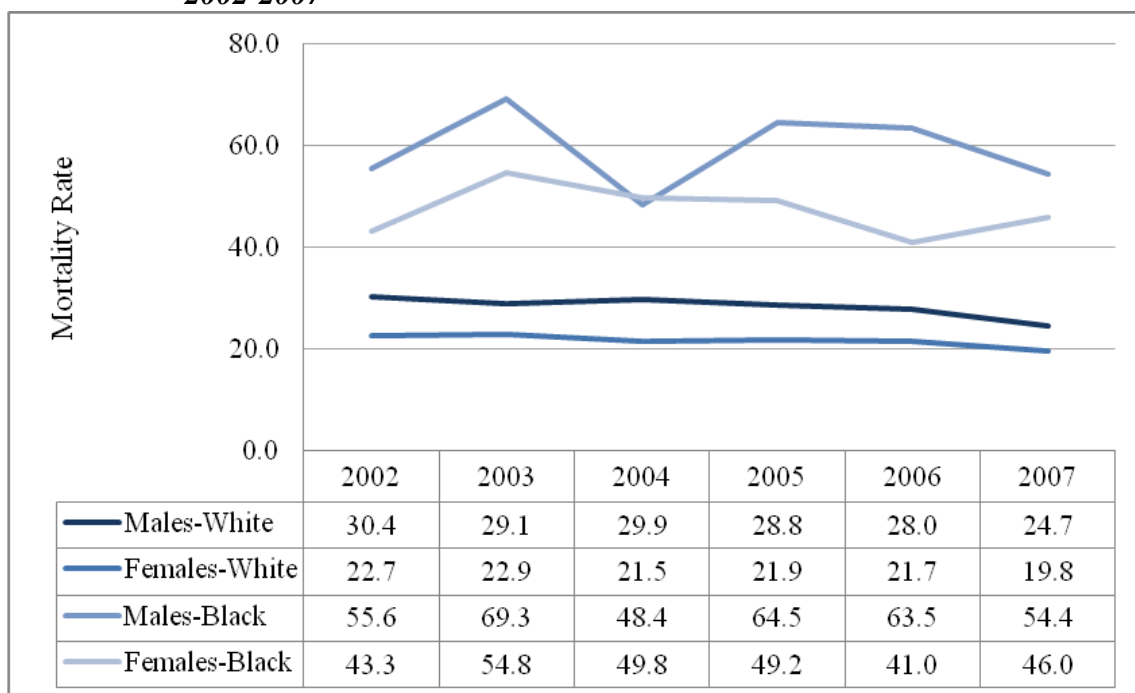
Source: Indiana State Department of Health 2002–2007 Mortality Data

Figure 48: Deaths due to Diabetes by Race and Gender, Indiana, 2002-2007



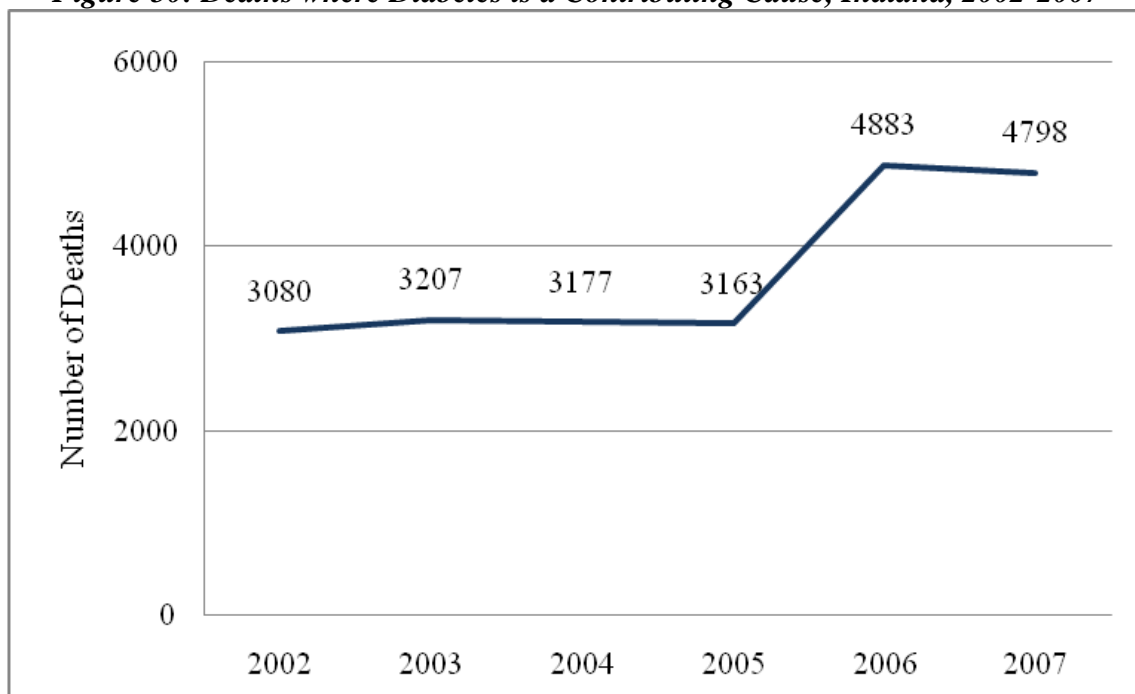
Source: Indiana State Department of Health 2002–2007 Mortality Data

Figure 49: Diabetes Mortality Rates by Race and Gender, Age-Adjusted, Indiana, 2002-2007



Source: Indiana State Department of Health 2002–2007 Mortality Data

Figure 50: Deaths where Diabetes is a Contributing Cause, Indiana, 2002-2007



Source: Indiana State Department of Health 2002–2007 Mortality Data

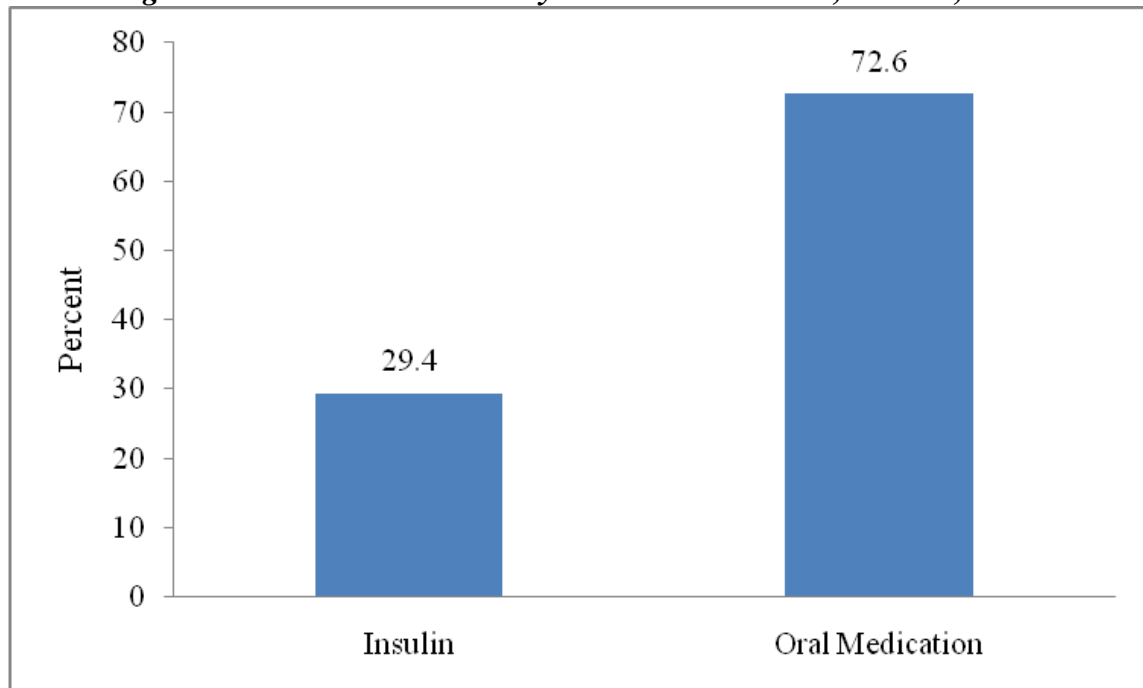
Treatment and the Prevention of Complications

Individuals with type 1 diabetes must take insulin via injection or insulin pump to survive. Type 2 diabetes can often be controlled by eating healthy foods, exercising, maintaining a healthy weight, and taking oral medications. Those with type 2 diabetes may also take insulin.⁽²⁾

Among Indiana adults with diabetes, oral medications were the most common form of treatment (72.6%). Insulin was used by 29.40% (Figure 51). A combination of therapies was used by 57.3% of individuals. However, 21.0% did not use either insulin or oral medications. The type of treatment used by adults with diabetes has remained consistent over the years (Figure 52).⁽⁶⁾ In addition, many individuals with diabetes needed to take medication to control high blood pressure and cholesterol.⁽²⁾

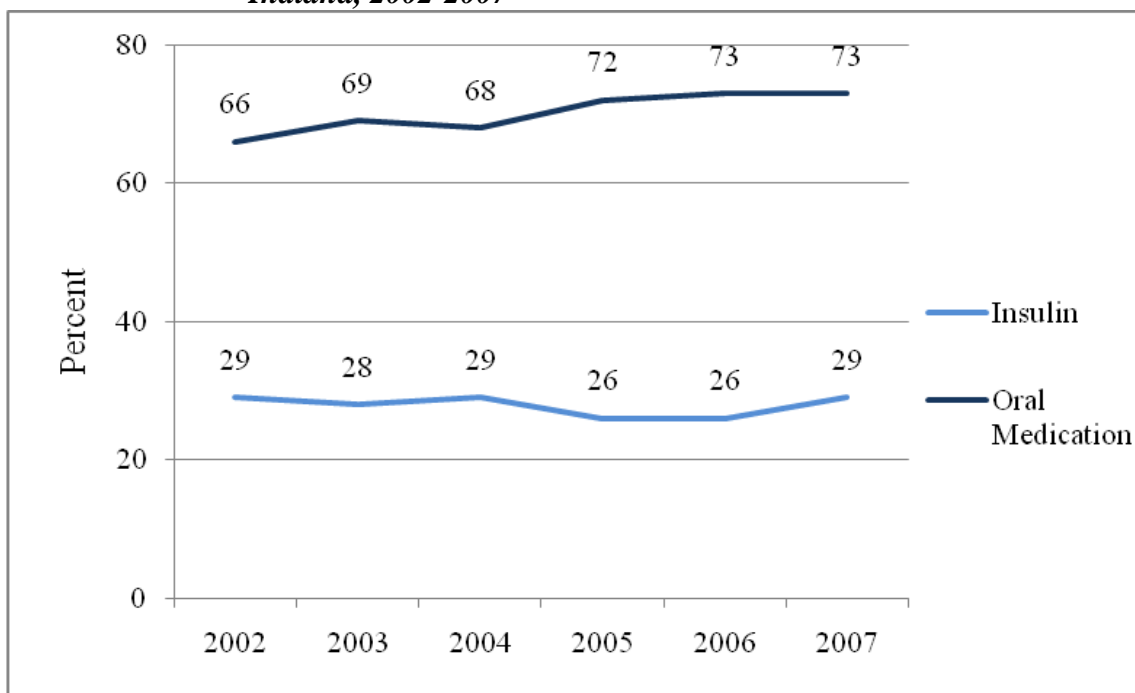
- *An estimated 115,000 adults in Indiana reported taking insulin.*
- *An estimated 284,000 adults in Indiana reported using diabetic pills*
- *An estimated 224,000 adults in Indiana reported using insulin and pills*

Figure 51: Medications Taken by Adults with Diabetes, Indiana, 2007



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.
Question: "Are you now taking insulin?" and "Are you taking diabetes pills?"
Source: Indiana 2007 BRFSS Data

Figure 52: Insulin or Oral Medication Use among Adults with Diabetes, Indiana, 2002-2007



Categories are not mutually exclusive. In some cases, individuals use both insulin and pills. Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older. Questions: "Are you now taking insulin?" and "Are you taking diabetes pills?"
Source: Indiana 2002-2007 BRFSS Data

Prevention of Complications

Diabetes can affect many parts of the body and can lead to serious complications if not managed well. A team-based health care approach for the care and treatment of individuals with diabetes is best. The individual should also take an active role in self-management. It is important for individuals with diabetes to learn about their condition, treatment goals, and preventive measures. Self-management courses, active engagement with a physician, and diabetes educators are resources which can assist those affected by diabetes and those at high risk of developing the disease. Controlling blood glucose, blood pressure, and blood lipids may reduce the likelihood of developing complications.⁽¹⁸⁾

Prevention of Diabetes Complications

- For every 1% reduction in results of A1C blood tests, the risk of developing micro-vascular diabetic complications are reduced by 40%
- For every 10 millimeters of mercury reduction in the risk for any complication related to diabetes is reduced by 12%
- Improved control of cholesterol or blood lipids reduces cardiovascular complications by 20% to 50%

Treatment Goals

Goals for diabetes treatment focus on the “ABCs”: A1C, blood pressure, and cholesterol. An A1C, also known as glycosylated hemoglobin or HbA1c, test measures an individual’s average blood glucose control for the past 2 to 3 months. The results indicate whether the diabetes treatment plan is effective. For non-pregnant individuals with diabetes, the target for A1C tests is less than 7%. Blood pressure is a measurement of the force applied to the walls of the arteries as the heart pumps blood through the body and tends to be higher in those with diabetes. The treatment goal for individuals with diabetes for blood pressure (mmHg) is <130 / <80. The treatment goal for cholesterol (lipid profile) has three targets: <100 for LDL; >40 mg/dl for male HDL levels and >50 mg/dl for female HDL levels; and <150 mg/dl for triglycerides. Individual treatment goals include achieving A1C results as close to normal (<6% in individuals without diabetes) as possible without significant hypoglycemia, with less stringent goals for those with severe or frequent hypoglycemia or if other factors exist (e.g. limited life expectancy), and lower blood pressure goals for individuals with nephropathy.^(18, 19)

Individuals with diabetes should receive medical care from a physician-coordinated team of health care professionals. There are specific measures that should be taken during the individuals’ lifetime in order to maintain health and avoid diabetic complications. The table below outlines these treatment measures that should be used to guide health care professionals when working with individuals with diabetes.⁽¹⁹⁾

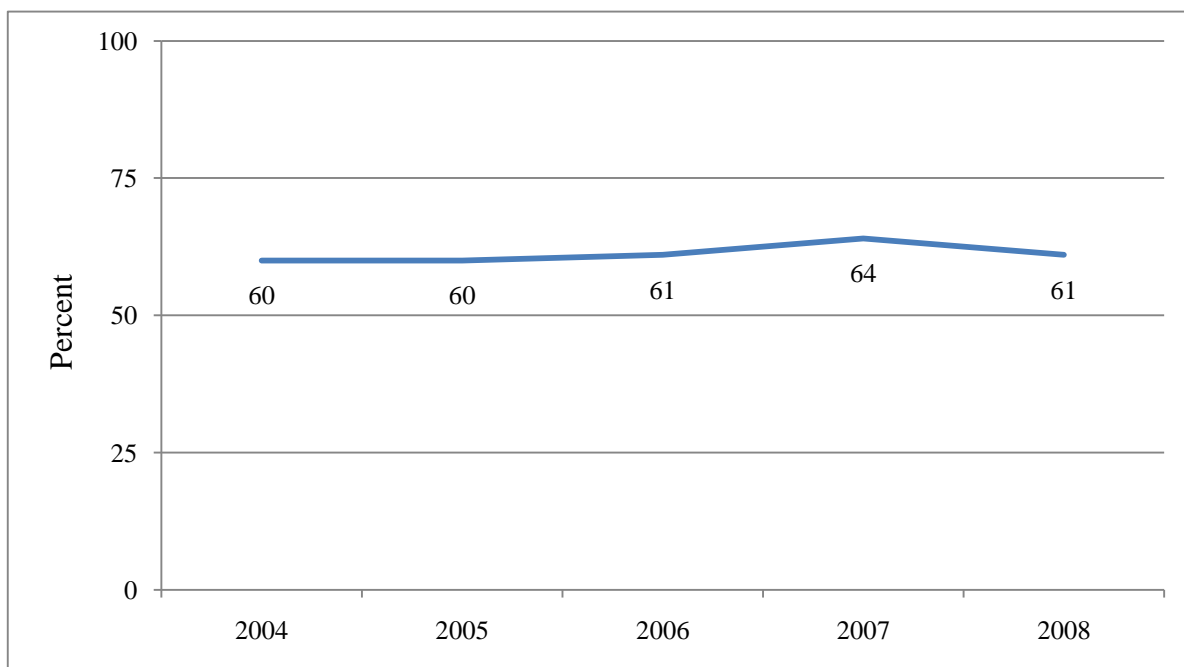
Treatment Measures	Frequency
Measure weight and blood pressure	Every regular physician visit
Inspect feet	Every regular physician visit
Review self-monitoring glucose record	Every regular physician visit
Review/adjust medications to control glucose, lipids, and blood pressure	Every regular physician visit
Review self-management skills, dietary needs, and physical activity	Every regular physician visit
Assess for depression or other mood disorders	Every regular physician visit
Counsel on smoking cessation and alcohol use	Every regular physician visit
Obtain A1C in patients whose therapy has changed or who are not meeting glycemic goals	Quarterly
Obtain fasting lipid profile (every two years if at goal)	Annually
Obtain serum creatinine and estimate glomerular filtration rate	Annually
Perform urine test for albumin-to-creatinine ratio in patients with type 1 diabetes ≥5 years and in all patients	Annually
Refer for dilated eye exam (if normal, an eye care specialist may advise an exam every 2-3 years)	Annually

Perform a comprehensive foot exam	Annually
Refer for dental/oral exam at least once a year	Annually
Administer influenza vaccination	Annually
Review need for other preventative care or treatment	Annually
Administer pneumococcal vaccination (repeat if over 64 years of age or immunocompromised and last vaccination was more than 5 years ago)	Lifetime

Self-Management Class

Diabetes self-management classes are essential for helping those with diabetes understand their condition and how to care for themselves. These courses are offered at local health departments, clinics, and hospitals. Topics include understanding diabetes and its effects on the body; monitoring blood glucose; nutrition; understanding the role of medications; exercise and the importance of maintaining a healthy weight; preventing complications by detecting problems early; proper foot, skin, and dental care; working with health care providers; and other self-management topics.⁽¹⁸⁾ Of adults with diabetes in Indiana, 61.4% reported that they have taken a course or class to help them manage their diabetes which was a slight increase from previous years (Figure 53).⁽⁶⁾

Figure 53: Adults with Diabetes who have Taken a Diabetes Self-Management Class, Indiana, 2004-2008



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.

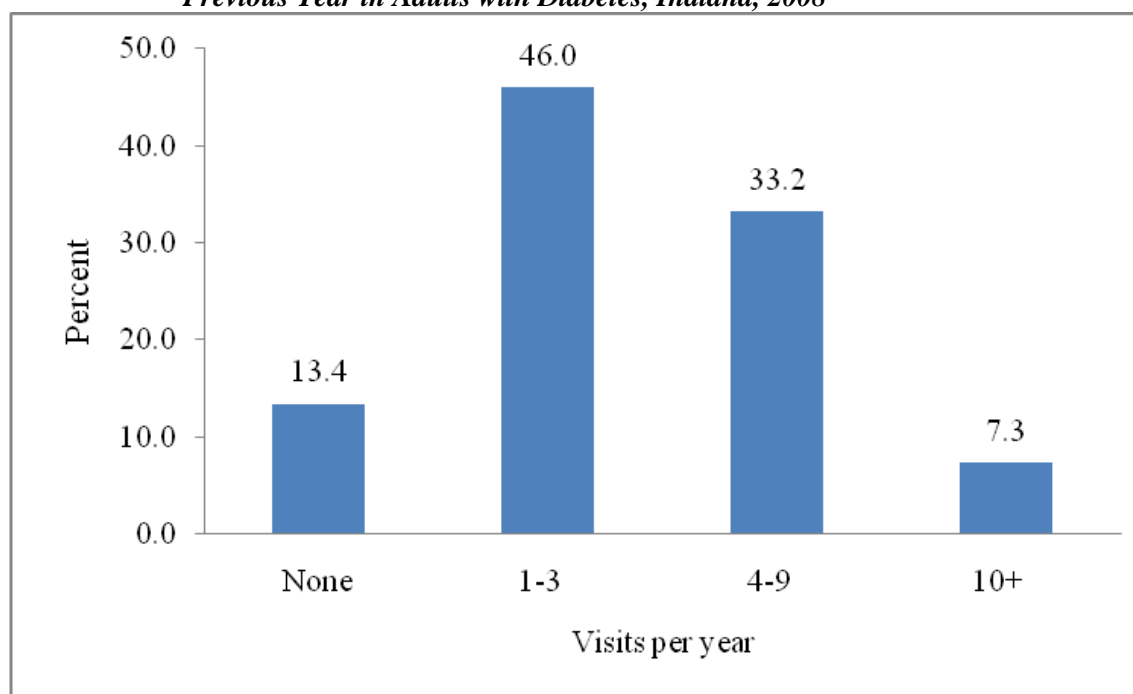
Question: "Have you ever taken a course or class in how to manage your diabetes yourself?"

Source: Indiana 2004-2008 BRFSS Data

Regular Visits to Health Care Providers

It is important for individuals with diabetes to see a health care professional regularly to monitor their disease and to detect and prevent complications. According to the 2008 BRFSS, 86.6% of Indiana adults with diabetes saw a health care professional for their diabetes at least once in the previous year with the most common frequency being 1-3 times (Figure 54). Unfortunately, 13.4% did not report a visit in the past year.⁽⁶⁾

Figure 54: Frequency of Health Professional Consultation about Diabetes during the Previous Year in Adults with Diabetes, Indiana, 2008



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.

Question: "About how many times in the past 12 months have you seen a doctor, nurse, or other health professional for your diabetes?"

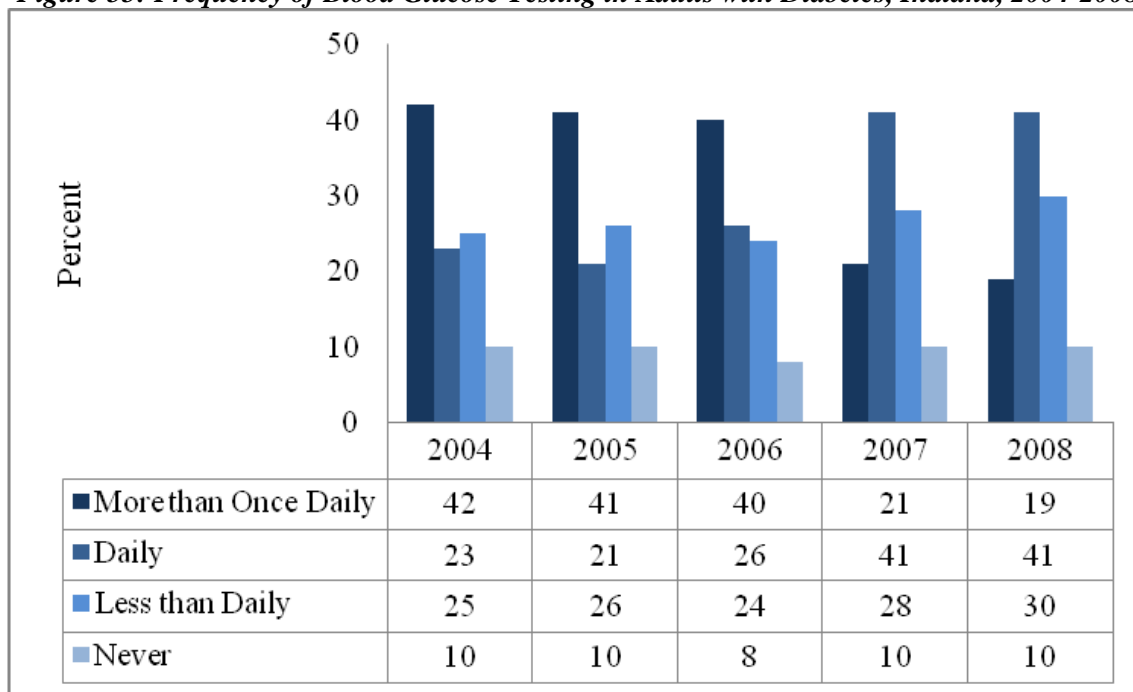
Source: Indiana 2008 BRFSS Data

Glucose Control

Studies have shown that improved glucose control benefits individuals with type 1 and type 2 diabetes. For every percentage point drop in A1C blood test results, the risk of micro-vascular complications (eye, kidney, and nerve disease) is reduced by 40%.⁽²⁾ Daily glucose checks and A1C testing (twice a year at least three months apart if meeting treatment goals and quarterly if not meeting goals) helps those with diabetes monitor their glucose levels so they know if and when adjustments are necessary.⁽¹⁸⁾

According to the 2008 BRFSS, 61.1% of Indiana adults with diabetes reported that they checked their glucose level at least once daily; however, 28.8% stated that they checked their glucose levels less than once daily and 10.2% never checked their levels (Figure 55). In 2008, over 75% of adults with diabetes reported having the A1C test in the past year (Figure 56). Approximately 6.1% did not know when they last had the test, and 5.5% had never heard of the test.

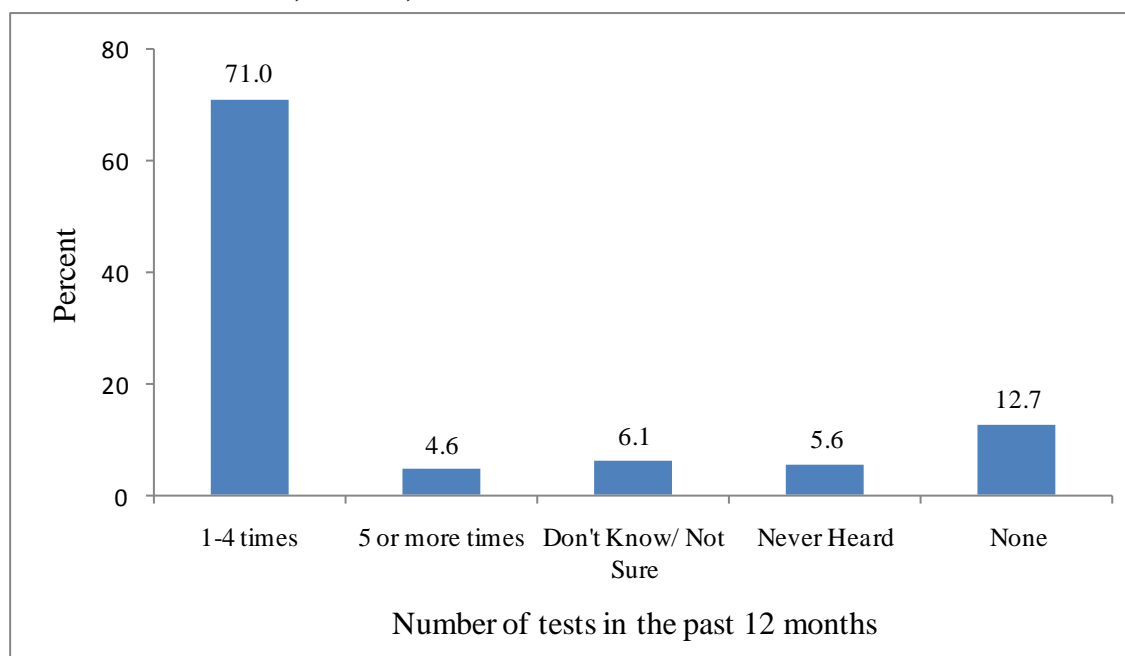
Figure 55: Frequency of Blood Glucose Testing in Adults with Diabetes, Indiana, 2004-2008



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.
 Question: "About how often do you check your blood for glucose or sugar? Include times when checked by family member or friend, but do not include times when checked by a health professional."

Source: Indiana 2004-2008 BRFSS Data

Figure 56: Frequency of A1C Testing during the Previous 12 Months in Adults with Diabetes, Indiana, 2008



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.
 Question: "About how many times in the past 12 months has a doctor, nurse, or other health professional checked your hemoglobin 'A one C'?"

Source: Indiana 2008 BRFSS Data

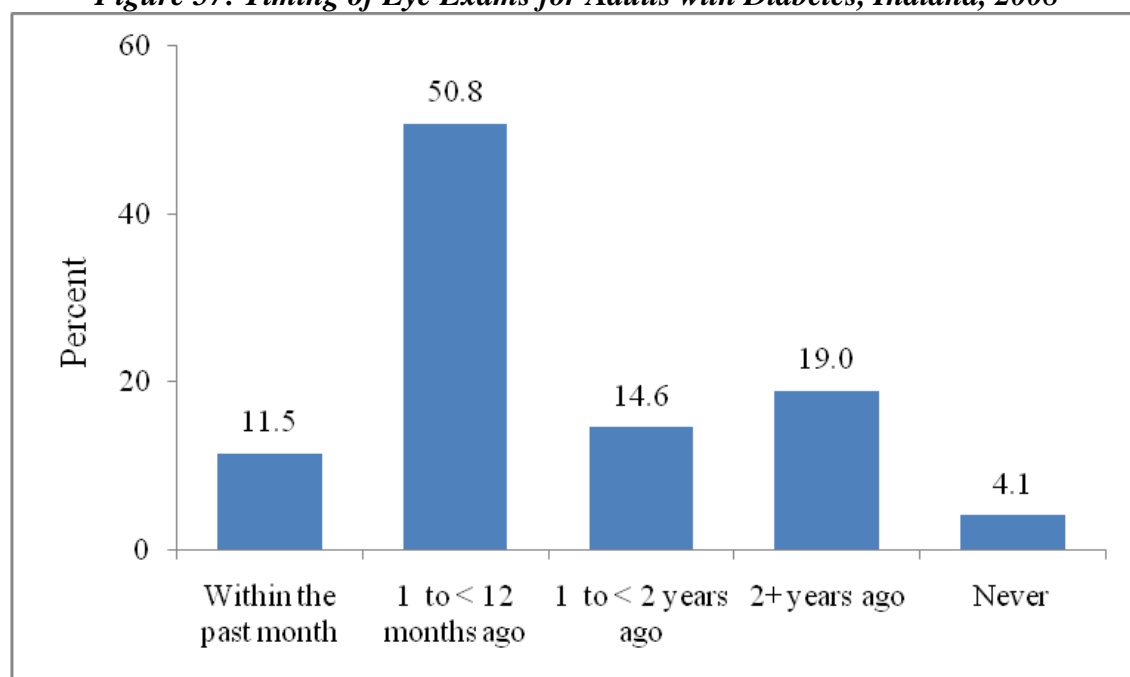
Blood Pressure and Lipid Control

Controlling blood pressure among individuals with diabetes helps to reduce the risk of heart disease and stroke by 33-50%. It also reduces the risk of microvascular complications (eye, kidney, and nerve diseases) by about 33%. For every 10 mmHg reduction in systolic blood pressure, the risk of complications is reduced by 12%. Detecting and treating early diabetic kidney disease by lowering blood pressure can reduce the decline in kidney function by 30-70%. ACE inhibitors and angiotensin receptor blockers are more effective in reducing kidney function decline than other blood pressure lowering medications.⁽²⁾ Of Indiana adults with diabetes, 93% reported taking medication to control their high blood pressure in 2008.⁽⁶⁾ Improving cholesterol or blood lipids can reduce cardiovascular complications by 20-50%.⁽²⁾ In 2008, 93% of Indiana adults with diabetes reported that they had their cholesterol checked in the previous year, and 63% reported that they were told they had high cholesterol.⁽⁶⁾

Eye Exams

Detecting and treating diabetic eye disease with laser therapy can reduce the development of severe vision loss by about 50-60 %.⁽²⁾ Of adults with diabetes in Indiana, 50.8% reported having a dilated eye exam in the previous year; however, 4.1% had never had a dilated eye exam (Figure 57).⁽⁶⁾

Figure 57: Timing of Eye Exams for Adults with Diabetes, Indiana, 2008



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.

Question: "When was the last time you had an eye exam in which the pupils were dilated?"

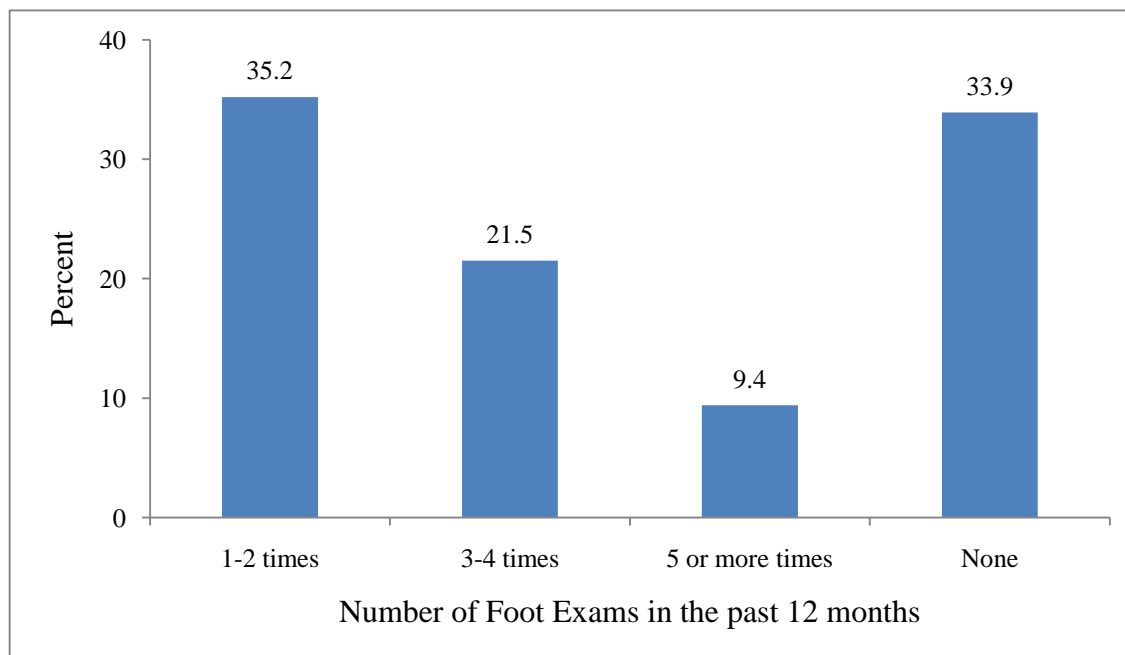
Source: Indiana 2008 BRFSS Data

Foot Exams

Regular comprehensive foot exams can reduce amputation rates by 45-85 %.⁽²⁾ In 2008, 66.1% of Indiana adults with diabetes reported that they had at least one foot exam performed by a health care professional in the previous year, while over 33% had none (Figure 58). In addition to seeing a doctor for a yearly foot exam, it is recommended that adults with diabetes check their feet daily for sores or

irritations to reduce the risk of infection and amputation. In 2008, 62.9% of Indiana adults with diabetes checked their feet daily; however, 15.4% never checked their feet (Figure 59).⁽⁶⁾

Figure 58: Frequency of Professional Examination of Feet for Adults with Diabetes, Indiana, 2008

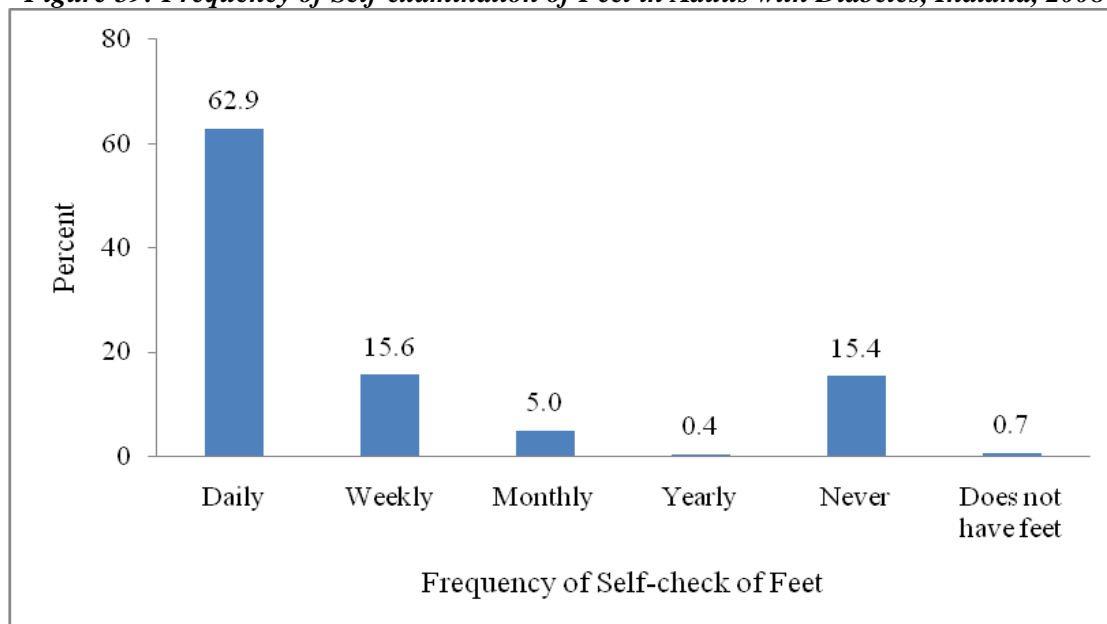


Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.

Question: "About how many times in the past 12 months has a health professional checked your feet for any sores or irritations?"

Source: Indiana 2008 BRFSS Data

Figure 59: Frequency of Self-examination of Feet in Adults with Diabetes, Indiana, 2008



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.

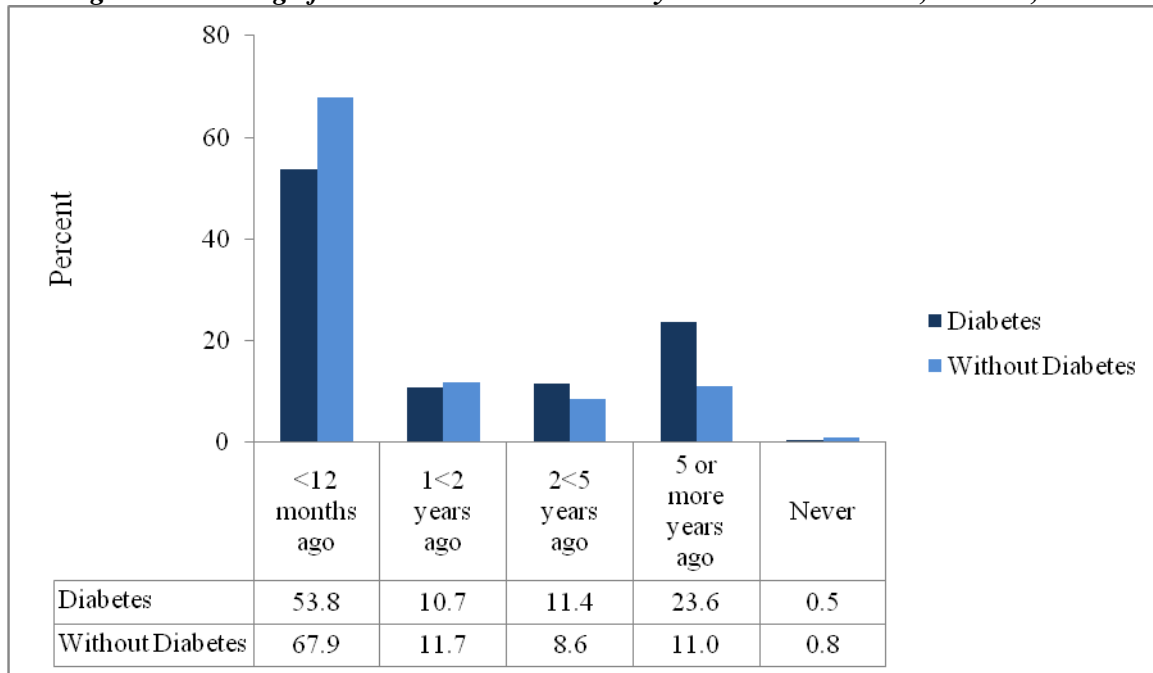
Question: "About how often do you check your feet for any sores or irritations? Include times when checked by family member or friend, but do not include times when checked by a health professional."

Source: Indiana 2008 BRFSS Data

Dental Exams

Regular dental exams are important to detect and prevent periodontal disease.⁽²⁾ Although individuals with diabetes are at a higher risk of having dental disease, they are less likely to receive regular dental care. In 2008 only 53.8% of Indiana adults with diabetes reported that they had a dental exam in the previous year, compared to 67.9% in those without diabetes (Figure 60).⁽⁶⁾

Figure 60: Timing of Most Recent Dental Care by Diabetes Prevalence, Indiana, 2008



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.

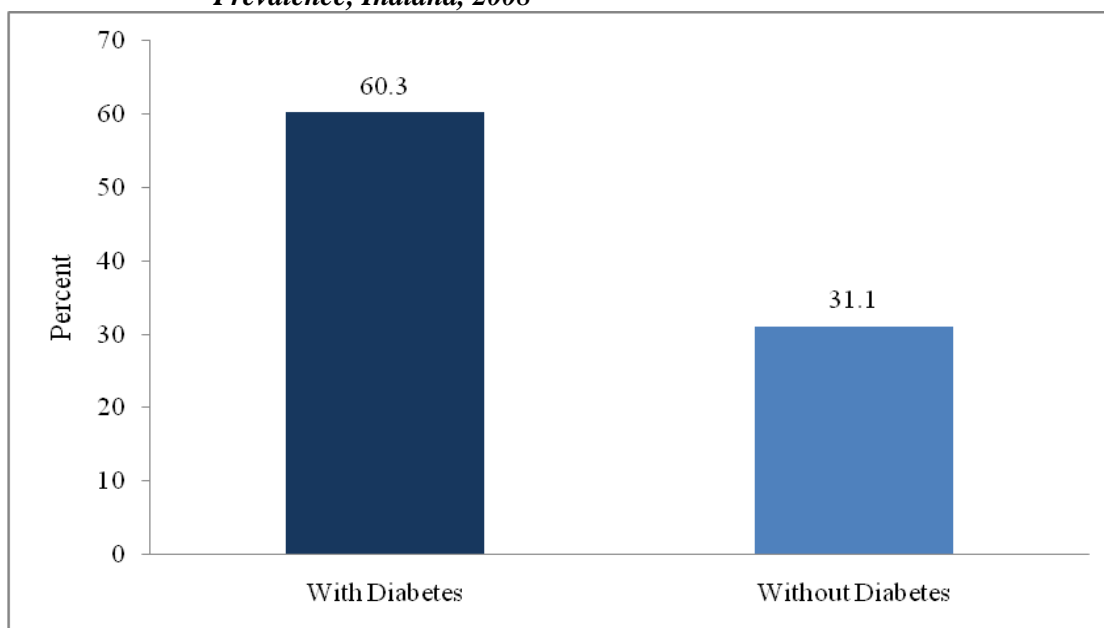
Question: "How long has it been since you last visited a dentist or a dental clinic for any reason? Include visits to dental specialists, such as orthodontists."

Source: Indiana 2008 BRFSS Data

Other Preventive Measures

Individuals with diabetes have worse outcomes when they become ill with influenza and/or pneumonia compared to the general population. Yearly influenza vaccinations and a pneumonia vaccination can help to prevent illness. Of adults with diabetes, 60.3% reported in 2008 that they had a flu vaccination in the past 12 months, and 55.3% have had a pneumonia vaccination at some point in their lives (Figures 61 and 62). Quitting smoking, exercising regularly, eating healthy foods, and maintaining a healthy weight is also important for reducing complications. Smoking triples the risk for heart disease in those with diabetes.⁽²⁾ In 2008, 21.5% of Indiana adults with diabetes were currently smoking (Figure 63). Of adults with diabetes, 33.5% were overweight, and 52.8% were obese (Figure 64). Additionally, nearly 48.7% of adults with diabetes reported not participating in any physical activities in the past 30 days (Figure 65).⁽⁶⁾

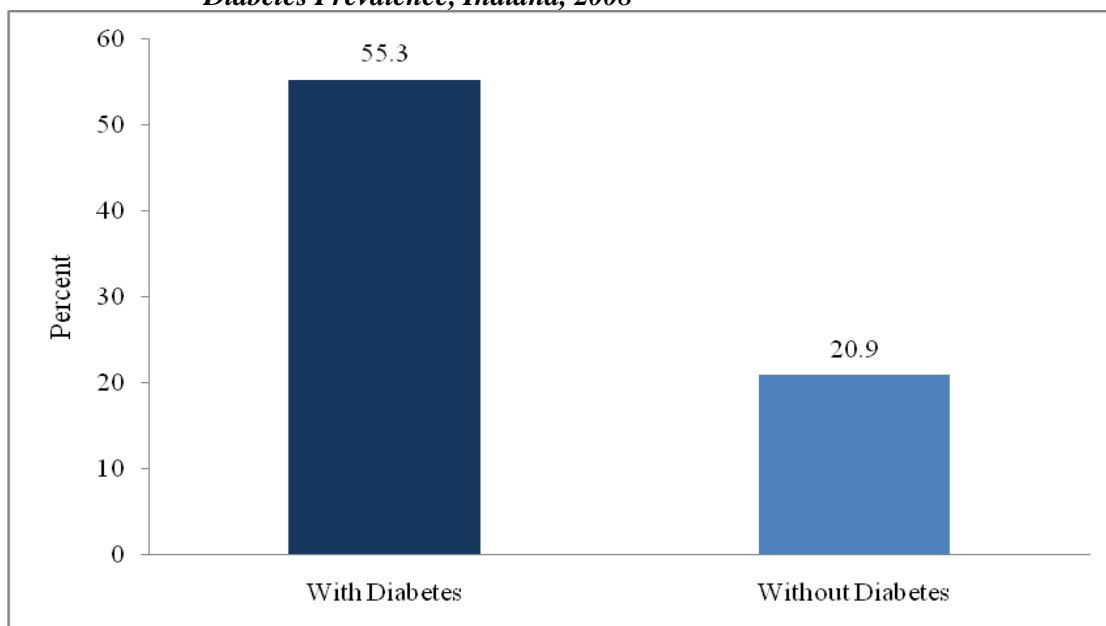
Figure 61: Adults who had a Flu Vaccination in Past 12 Months by Diabetes Prevalence, Indiana, 2008



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older. Question: "A flu shot is an influenza vaccine injected into your arm. During the past 12 months, have you had a flu shot?"

Source: Indiana 2008 BRFSS Data

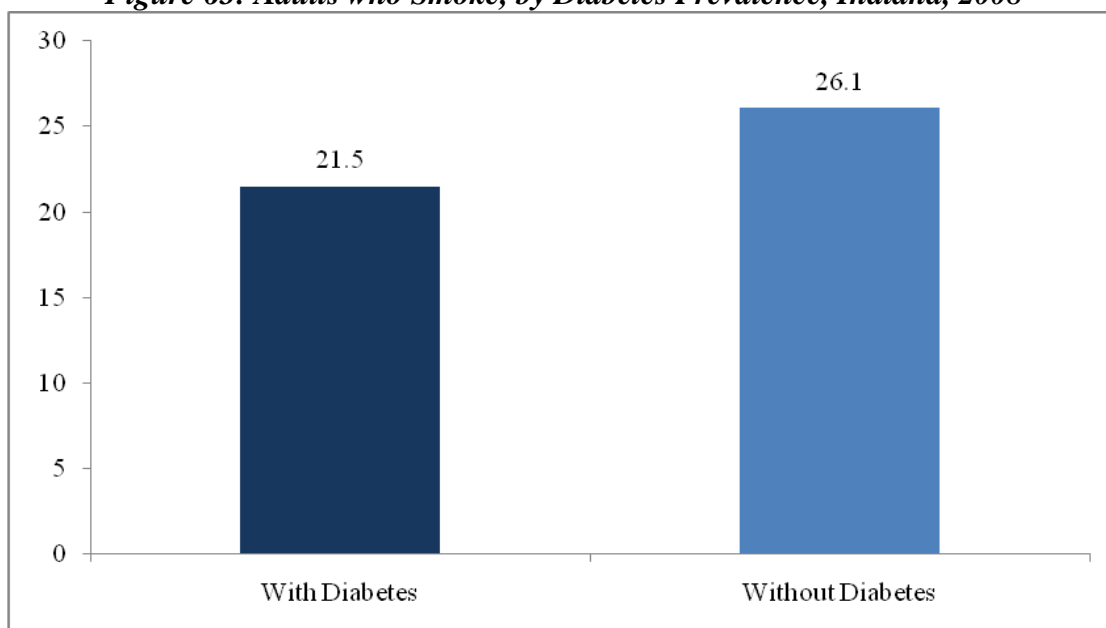
Figure 62: Adults who have had a Pneumonia Vaccination in Their Lifetime by Diabetes Prevalence, Indiana, 2008



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older. Question: "A pneumonia shot or pneumococcal vaccine is usually given only once or twice in a person's life and is different from the flu shot. Have you ever had a pneumonia shot?"

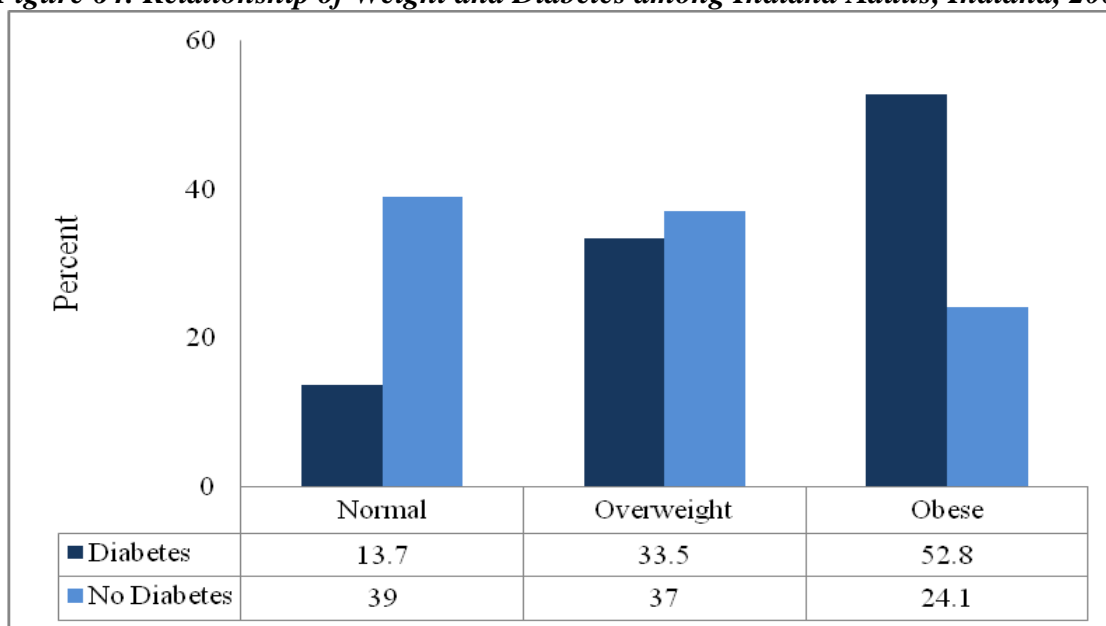
Source: Indiana 2008 BRFSS Data

Figure 63: Adults who Smoke, by Diabetes Prevalence, Indiana, 2008



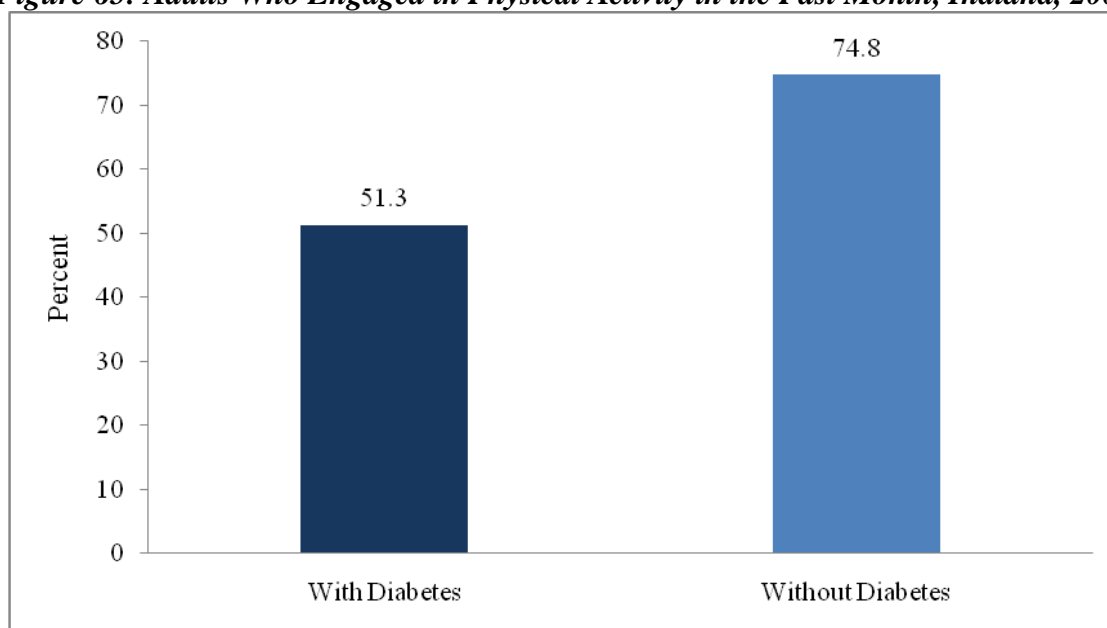
Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.
 Question: "Do you now smoke cigarettes every day, some days, or not at all?"
 Source: Indiana 2008 BRFSS Data

Figure 64: Relationship of Weight and Diabetes among Indiana Adults, Indiana, 2008



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.
 Overweight: BMI 25.0 – 29.9 and obese: BMI > 30.0
 Question: "About how much do you weigh without shoes?" and "About how tall are you without shoes?"
 Source: Indiana 2008 BRFSS Data

Figure 65: Adults Who Engaged in Physical Activity in the Past Month, Indiana, 2008



Percentages are weighted to population characteristics. Survey was asked of individuals 18 years or older.

Question: "During the past month, did you participate in any physical activities?"

Source: Indiana 2008 BRFSS Data

Gaps and Barriers to Diabetes Care

While Indiana has many resources in diabetes research and education, a gap remains between these programs and the diabetes education and management received by most patients in a clinical setting. Barriers include the cost of disease management and services, geographic location, access to and quality of care, and cultural barriers such as language and lack of minority physicians.

Cost

Diabetes is an expensive chronic disease to manage. Costs include regular physician visits, medications, supplies, treatment and hospitalizations for complications, and educational programs. In 2007, the total annual economic cost of diabetes in the United States was estimated to be \$218 billion; including \$174.4 billion for diagnosed diabetes. This figure is composed of \$116 billion in excess medical expenditures and \$58 billion in reduced national productivity. The remaining cost resulted from \$18 billion spent on undiagnosed diabetes, \$25 billion for pre-diabetes, and \$636 million for gestational diabetes.

While \$27 billion dollars was spent on diabetes specific direct care, \$58 billion was spent on complications due to diabetes, and \$31 billion was associated with excess general medical care. The largest components were for inpatient hospital care (50%), medication and supplies (12%), retail medications to treat complications (11%), and physician office visits (9%). Individuals with diabetes incurred an average expenditure of \$11,744 per year (\$6,649 attributed to diabetes), which is about 2.3 times higher than what expenditures would be in the absence of diabetes. One out of every five health care dollars spent in the United States is spent on caring for an individual with diabetes while one in every ten dollars is attributed to diabetes. This cost data does not include social costs such as pain and suffering, care provided by nonpaid caregivers, or excess medical costs associated with undiagnosed diabetes, therefore the cost is likely to be much greater.⁽²⁰⁾ The estimated cost incurred by the State of Indiana is \$3.94 billion.*

Geographic Location

Individuals with diabetes who live in urban and rural areas have unique challenges. In both settings, physical access may be a significant barrier to appropriate care. For individuals seeking diabetes services in either setting, access will be highly influenced by proximity to care and the availability of transportation resources. Metropolitan areas typically contain the highest concentration of subspecialty physicians and diabetes specific services. However, the distribution of providers within a metropolitan area may prove to be an obstacle to consistent diabetes care, even for those in urban settings.⁽²¹⁾

Approximately one-third of Indiana's population lives in rural counties.⁽¹⁰⁾ Rural areas typically have lower levels of income, and a higher proportion of elderly compared to urban settings.⁽¹⁰⁾ Because of the higher prevalence of diabetes among the elderly and those with lower income, a significant portion of the population with diabetes may not be able to seek care outside their

* Figure based upon 2008 BRFSS prevalence data, annual estimates of undiagnosed diabetes and average annual health care costs specifically attributed to diabetes.

immediate communities, and consequently may have insufficient care. Such issues pose problems for individuals with a chronic disease, such as diabetes, because constant monitoring and contact with a physician or health care provider are essential for successful treatment.⁽²¹⁾

Access to and Quality of Care

Access to medical care and coverage of care is also a challenge in Indiana. In 2007-2008, an estimated 744,600 individuals (11.9%) were uninsured. Another 26% of individuals (1,637,900) had either Medicaid (12.7%) or Medicare (13.4%) as their primary form of health insurance coverage.⁽²²⁾ In 2004 approximately 86,968 Medicaid patients had one of the following four chronic diseases: diabetes, congestive heart failure, asthma, or AIDS. Of these patients, 21% (18,030 individuals) had diabetes. Fifty-seven percent of all Medicaid patients and 60% of Medicaid patients with diabetes visited public health clinics for their care.⁽²³⁾

Medicare reimbursements for diabetes have been hindered because of physicians' lack of knowledge of Centers for Medicare and Medicaid Services guidelines and because many physicians believe reimbursement levels are unrealistically low for the services need for proper care.⁽²⁴⁾ In addition, Indiana law does not require insurance plans to cover the cost of diabetes medications and supplies if the company is self-insured.⁽²⁵⁾

Fifty-one of the 92 Indiana counties were classified as medically underserved areas and 36 of the 92 counties had health professional shortages.^(26, 27) Indiana has one of the lowest numbers of physicians for its population size with only 215 physicians per 100,000 resident population, ranking Indiana 38th in the nation for physician-to-population ratio.⁽²⁸⁾

Throughout rural and urban Indiana, there are 42 community health centers (CHC) which receive funds from ISDH to provide services to uninsured and under-insured Indiana residents. Sixteen of these community health centers also receive funding from the Bureau of Primary Health Care through the Federal 330 grant program. Receiving this funding designates the centers as Federally Qualified Health Centers (FQHC). In 2006, 39 of the 42 CHCs reported they served 331,010 individuals, with 113,046 enrolled in Medicaid and 118,017 with no insurance.⁽²⁹⁾

The FQHCs participating in the Bureau of Primary Health Care's Health Disparities Collaborative (HDC) have begun tracking and following their diabetic population through health center registries. The HDC program encourages health centers to embed the evidence-based guidelines from the American Diabetes Association into their processes so that they can assist their partners to reach the goal of 7.0 for the average hemoglobin A1C. The August 2007 aggregate data from 14 of Indiana FQHCs participating in the HDC reported that 6,690 individuals with diabetes are being served, and their average hemoglobin A1C is 7.8 (the national average is 7.76).⁽²⁹⁾

Cultural Barriers

Indiana's Hispanic population has increased and is concentrated in several rural counties and in close-knit urban communities.⁽¹⁰⁾ In rural areas, there are few bilingual health services available with the exception of those offered by the Migrant Health Program. In Indianapolis, there is a

Hispanic Center and the Wishard Hospital Hispanic Health Project with branches in other urban areas. However, the Hispanic Center and Wishard primarily serve the metropolitan Indianapolis area. There are often cultural and language barriers to optimal health delivery, especially for newly immigrated residents in rural areas where few Hispanic individuals have resided in the past.⁽³⁰⁾

Research has demonstrated that racial and cultural factors influence patient outcomes and satisfaction. In Indiana, less than 4% of physicians are non-Hispanic black and less than 3% are Hispanic, while their respective groups compose more than twice those levels in the general population. In some urban settings, this provider-patient non-congruence is especially evident. At Wishard Health Services, for example, more than 46% of the patients cared for were non-Hispanic black and at several of Wishard's community health centers, more than 30% of patients were Hispanic.⁽³⁰⁾ Although a major shift in provider characteristics may be difficult, steps taken toward improving cultural competence among health care providers may enhance the quality of care for minority and at risk populations.

Looking to the Future

Diabetes presents a tremendous challenge in Indiana and the United States. The World Health Organization estimates that the number of adults in the United States with diabetes will double by the year 2030.⁽³¹⁾ The rates of obesity and diabetes are on the rise in Indiana as well as the rate of individuals developing complications due to diabetes. Diabetes-related mortality and morbidity, amputations, blindness, and kidney disease cause needless suffering and unnecessary financial burden on individuals and Indiana's economy. The Indiana Diabetes Prevention and Control Program (DPCP) works to overcome the various barriers where it will have an impact and to reach more individuals with diabetes and those at risk for diabetes.

The DPCP's mission is to reduce the burden of diabetes in Indiana through data surveillance, health communications, health systems development, and development and implementation of community interventions and programs. To achieve its mission, the DPCP works closely with the Diabetes Advisory Council (DAC), a group of diabetes' experts and clinicians, who guide and support the activities of the DPCP. The focus of the DAC is to increase public awareness of the impact of diabetes, to improve the quality of life for those who are affected by diabetes, to improve the quality of care for patients with diabetes, and to reduce the burdens imposed by diabetes in Indiana.

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